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MARKETING ALTERNATIVES FOR ALASKA NORTH SLOPE NATURAL GAS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY REGULATION

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

MARKETING ALTERNATIVES FOR ALASKA NORTH SLOPE NATURAL GAS

NOVEMBER 16, 1983

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MARKETING ALTERNATIVES FOR ALASKA NORTH SLOPE NATURAL GAS

WEDNESDAY, NOVEMBER 16, 1983

U.S. SENATE,
SUBCOMMITTEE ON ENERGY REGULATION,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, D.C.

The subcommittee met, pursuant to notice, at 2 p.m., in room SD-366, Dirksen Office Building, Hon. Frank H. Murkowski, presiding.

Present: Senator Murkowski.

Also present: Howard Useem, professional staff member, and Elizabeth Moler, counsel for the minority.

OPENING STATEMENT OF HON. FRANK H. MURKOWSKI, A U.S. SENATOR FROM THE STATE OF ALASKA

Senator **MURKOWSKI.** I call the Subcommittee on Energy Regulation of the Committee on Energy and Natural Resources to order. I apologize that some of the witnesses have not been able to be seated. We will make an effort to accommodate them by urging your cooperation. If you get tired of sitting or bored or anything else, I'm sure that you would find your seat readily available by someone else. We will do our best to accommodate you. There might be some room on the sides. I leave that to the discretion of the officer in the back. Or if we could bring in any more chairs it would be all right with me.

I am told that the usual time allotted actually pertains in this case. With that, I will get into my formal remarks.

Today the subcommittee will explore alternatives to marketing of Alaska's abundant supplies of natural gas. These are proven reserves of approximately 26 trillion cubic feet of gas and that is recognized primarily in the Prudhoe Bay area, in addition to the 109 trillion cubic feet of undiscovered but recoverable gas which is estimated to exist in Arctic Alaska.

You will recall in 1977, the President and Congress approved the construction of a 4,800-mile pipeline system, the Alaska Natural Gas Transportation System or ANGTS as it became known, to move the gas from Alaska to the lower 48 States. This system was intended to be completed by 1983.

Of course 1983 is with us today and Canadian gas is the only gas flowing through the completed portions of the pipeline. Alaska gas, on the other hand, is being reinjected into the ground at the rate of 2 billion cubic feet per day.

Several major events have occurred since Congress last looked at this issue in 1981. On November 11, just a few days ago, President Reagan and Prime Minister Nakasone of Japan issued a joint communique emphasizing the importance of United States-Japanese cooperation in the development of Alaskan gas and other energy resources. This communique recognizes that the market for Alaska's gas may not lie solely in the lower 48, but also in the Pacific rim. The possibilities for the export of Alaska's natural gas resources are largely unexplored. I hope this hearing may help lay the foundation for determining where the most likely markets for Alaska's gas may be.

Over the past year, we have seen other major developments, namely the acquisition of Northwest Energy, the leader of the ANGTS consortium, by the Williams Co.

We have also seen the creation of a new company with a new idea. This company, the Yukon-Pacific Corp., envisions the construction of a pipeline to carry North Slope gas to the south coast of Alaska where it would be converted to liquified natural gas (LNG) and shipped to foreign markets in the Pacific Rim.

As a consequence of these developments, it is appropriate that Congress again examine the issue of Alaska gas. We must not ignore the issue, because the continued inability to move Arctic Alaska gas will inevitably hinder exploration and production efforts on Alaska's North Slope, an area we currently depend on for 20 percent of our domestically produced oil. Further, we must realize that exploration efforts on Alaska's North Slope focus on oil and not gas, because there is no pipeline in place, obviously, to move the gas. One can only speculate on what Alaska's gas reserves might be.

As a part of the discussions we must also recognize the Canadians also want to market their gas in the Pacific rim. Their primary competition could come from Alaska. The best way to eliminate Alaska competition for those markets, it would seem, would be for the Canadians to point to so-called commitments and obligations to proceed with the construction, and argue that Alaska gas can only be moved through a trans-Canadian pipeline to U.S. markets. Further, Canada may wish to continue marketing gas that costs less than that of Alaska gas for the user.

On several occasions we have committed ourselves to the construction of ANGTS provided of course that it could be financed privately. If we assume for a moment that the market concerned with ANGTS cannot be privately financed given the current market conditions, then what commitment exists? I've asked you members of the panel to possibly respond. And if the private sector precluded from pursuing any other alternatives.

These are among the broader questions that this hearing will address.

However, because of a lengthy list of witnesses that wil be heard from in a relatively short time, I would ask that each of you as witnesses summarize your remarks as much as possible with the assurance that your written testimony will be included in the record in full as if read. Initially I'm going to limit each participant on each panel to approximately 5 minutes, and I'll fudge a couple of minutes on that, about 7 minutes; I will request that you summarize your remarks.

With that, gentlemen, I would introduce to you the first panel, and we are pleased to see before us again our good friend Hon. John T. Rhett, Federal Inspector, Office of the Federal Inspector, Alaska Natural Gas Transportation System. It's nice to have you with us again. And we have the Hon. Jan Mares, Assistant Secretary, Fossil Fuels, Department of Energy. We welcome you. And the last gentleman, Mr. E. Allan Wendt, Deputy Assistant Secretary for Economic Affairs, Department of State. We welcome you, Mr. Wendt to the committee, and would request that you present your testimony in whatever order you individually or collectively have decided.

STATEMENT OF HON. JOHN T. RHETT, FEDERAL INSPECTOR, OFFICE OF THE FEDERAL INSPECTOR, ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Mr. Rhett. Good afternoon Mr. Chairman and members of the committee. It is a pleasure to be here today. I would like to give a brief statement of the status of the Alaska Natural Gas Transportation System project from a technical and regulatory viewpoint to help provide background for today's hearing. A detailed history from our viewpoint is being provided for the record. I am also submitting a copy of our September 30, 1983, "Quarterly Report to Congress" which provides an excellent status report on the project.

Approximately $3.2 billion has been spent by the project sponsors and one-third of the mileage of the total system is now in place. About $2.3 billion of this was for the phase I portion, or prebuild, that is presently bringing Canadian gas to the United States. It was built on time and under budget, and, I might add, in an outstanding manner. The sponsors have spent approximately $700 million on regulatory and engineering matters, to include R&D, on the Alaskan leg to date. Our Canadian counterparts have spent over $200 million on phase II activities.

On the Alaskan leg, the bulk of the engineering needed to proceed with final design has been accomplished. This includes the necessary research work on the extremely difficult engineering problem of frost heave. We have approved 28 of the 31 sections of design criteria, which is the foundation for the final design, and we should be approving the remaining three sections during 1984. In addition, the sponsors have been and will be actively pursuing optimization studies to reduce costs and increase efficiency. The latest of these reduced the cost of the conditioning plant by $1 billion and cut 1 year off its construction time.

The bulk of the environmental and construction procedure plans will be completed in 1984, with the exception of a few that should be deferred until remobilization. The engineering to date, in my opinion, has been well done and will considerably reduce the risk of the unknowns that could lead to cost overruns during construction. All of these technical plans and criteria have been jointly reviewed and approved by the OFI and the State of Alaska. There has been excellent cooperation between the State and the Federal Government on all facets of the project.

All the basic regulatory actions have been completed except the final FERC certification, which requires gas contracts, the financing plan and marketability studies, and the State of Alaska right-of-way grant. This includes all major permits, the Federal right-of-way grant, and legislative action on the waiver package. The sponsors have spent approximately $10 million this year and have a proposed budget of $5 million for 1984 to complete the engineering and obtain our approval of the frost heave methodology.

The project engineering and the regulatory process have advanced to the point where, when the financing plan is obtained, the final design and construction can proceed expeditiously.

[The prepared statement of Mr. Rhett follows:]

STATEMENT OF JOHN T. RHETT
FEDERAL INSPECTOR
OFFICE OF THE FEDERAL INSPECTOR
FOR THE ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Before the
Subcommittee on Energy Regulation

Senate Energy and Natural Resources Committee
November 16, 1983

Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you today to discuss the Alaska Natural Gas Transportation System (ANGTS) and the role the Office of the Federal Inspector (OFI) has had in overseeing this extraordinary project to date.

Let me begin by giving you a short history of the project itself and the origins of the OFI. I will then give you a status report on the project from a technical, and regulatory viewpoint.

The ANGTS project was conceived following discovery, in 1968, of a huge reservoir of oil and natural gas at Prudhoe Bay on the North Slope of Alaska. The proven reserves of 9.6 barrels of oil and 26 trillion cubic feet of gas stimulated interest in moving the vast supplies to markets in the lower 48 States. The oil eventually began flowing, in June 1977, through the Trans-Alaskan Pipeline System (TAPS), which was built to transport the oil from the North Slope to the port of Valdez where the oil could be shipped by tanker. The natural gas is currently being reinjected to maintain field pressure and maximize oil recovery.

Domestic gas shortages, coupled with sharp oil price increases in the mid-1970s, encouraged plans for an Alaskan gas pipeline system. Between 1974 and 1976 three separate project groups applied to the Federal Power Commission (FPC) for certification to transport Alaskan gas. The Arctic Gas consortium proposed to build a pipeline east from Prudhoe Bay across the Arctic National Wildlife Range, down Canada's Mackenzie River Valley to Alberta where separate legs would deliver the gas to the U.S. Midwest and West Coast. The El Paso group wanted to construct a gas line along the oil line corridor to the Gulf of Alaska, where the gas would be liquified and shipped to California. Finally, the Alcan Pipeline Company submitted what was to become the approved system.

Because the sizeable Prudhoe reserves were viewed as critical to the Nation's total energy program, Congress passed the Alaska Natural Gas Transportation Act (ANGTA) of 1976, while the FPC was holding hearings on the three proposals. The ANGTA provided for the participation of the President and the Congress in the selection process and for the means to expedite construction and initial operation of the approved system. Pursuant to the requirements of the ANGTA, President Carter selected the Alcan proposal, the 4,800-mile joint U.S.- Canadian overland pipeline that could eventually deliver up to 2.4 billion cubic feet per day to markets in the lower 48. The Alcan project was found to be the most economically and environmentally acceptable proposal by the United States and Canada, whose National Energy Board had issued a decision to that effect in June 1977.

As proposed by Alcan, the pipeline would be of varying diameters and the first buried, chilled gas line ever built. The system route was based on paralleling the TAPS line from Prudhoe to Delta Junction, just southeast of Fairbanks. At Delta Junction the pipeline would turn southeast and generally follow the Alaska Highway across the Yukon Territory, British Columbia, and Alberta to James River Station. At James River, the system would divide into two legs. The Western Leg would cross British Columbia and then continue south through Idaho, Washington, and Oregon before terminating near Antioch, California. The Eastern Leg would turn east to cross Saskatchewan and the States of Montana, North Dakota, South Dakota, Minnesota, and Iowa, before terminating near Chicago, Illinois.

In 1977, completion of the entire system was targeted for January 1, 1983.

President Carter's message to Congress on the selection of the Alcan proposal consisted of a decision and a report (Decision and Report to Congress on the Alaska Natural Gas Transportation System). The decision designated the Alcan group as sponsors; described the 4,800-mile route; identified provisions of law requiring waiver; set forth the terms and conditions for enforcement; and included text of the U.S.-Canadian agreement on tariffs, cost controls and pipe procurement which had been approved by the Senate in October 1977. The Congress approved the President's selection on November 2, 1977.

The project was set up such that each Leg of the ANGTS would be designed, financed, constructed, owned, and operated by a different group of private natural gas transmission companies. The Alaskan segment of the system was sponsored by the Alaskan Northwest Natural Gas Transportation Company, a consortium of 10 pipeline companies. Northwest Alaskan Pipeline Company (formerly Alcan) is the consortium's operating partner. At a later date, the North Slope gas producers would join this effort through a cooperative agreement to share the engineering costs of the Alaskan Leg.

A consortium of five companies formed the Northern Border Pipeline Company to construct the Eastern Leg, of which Northern Plains Natural Gas Company was and continues to be the operating partner. Pacific Gas Transmission Company and its parent company, Pacific Gas and Electric Company, sponsored the Western Leg. The principal sponsor of the Canadian portion was Foothills Pipe Lines Ltd.

In the late 1970's it became evident that Canada had a growing exportable surplus of gas reserves in Alberta. As a result, the Alcan plan was modified to be constructed in two stages. The first stage, referred to as "prebuild" construction would entail building portions of the Eastern and Western Legs to transport Albertan gas to the lower 48. With this prebuild system Albertan gas would begin flowing several years before the North Slope gas came on line, thus providing cash flow and other immediate benefits to the participants and facilitating the financing and construction of the overall system.

The second stage of the system, known as Phase II construction, would be the completion of the Alaskan, northern Canadian portions, and lower 48 segments necessary to deliver the Alaskan natural gas to the continental United States. A gas conditioning plant, needed to remove impurities from the gas prior to shipment through the pipeline was also scheduled to be built during the second phase of construction. The conditioning plant was originally not a legal component of the ANGTS project.

In December 1977, the Federal Energy Regulatory Commission (FERC) issued conditional certification to the project sponsors to build the ANGTS, thereby enabling the companies to begin pipeline design and planning.

While design work was progressing in 1978, the FERC proposed, in May, an incentive rate of return structure, as required by the President's Decision, and the Congress adopted the President's preferred wellhead pricing policy for Alaskan production in November. Under the National Gas Policy Act (NGPA), the wellhead prices of natural gas produced from the Prudhoe Bay Unit system would be the equivalent of $1.45 per million BTUs in 1977 escalated by inflation. The NGPA also allowed for "rolled-in" pricing on Alaskan gas, a method by which comparatively high-priced Alaskan gas could be mixed for sale with less expensive domestic gas. Due to the lengthy debate in Congress on the NGPA and other delays, the Northwest Alaskan Pipeline Company revised the schedule in 1978 from a system completion date of January 1, 1983 to November 1, 1984.

The first half of 1979 was marked by a series of regulatory filings and actions to allow the pipeline sponsors to proceed with their planning and to begin construction on schedule. In January, the Northern Border filed for FERC approval to build the Eastern Leg prebuild segment at an estimated cost of $1.4 billion. In April, the FERC issued a notice of proposed rulemaking attaching values to each incentive rate of return component and it also ordered expedited hearings on the prebuild portion of the system.

In July 1979, the Office of the Federal Inspector for the Alaska Natural Transportation System officially began operations. This new, independent agency was created pursuant to the ANGTA, which authorized the President to select a Federal Inspector to be responsible for coordinating all Federal activities related to the pipeline project, and for assuring timely, efficient, and environmentally sound construction. That Congress specifically addressed the construction of an Alaskan gas pipeline was generally interpreted as a reaction to the schedule delays and cost overruns associated with the building of the TAPS. The problems experienced by the private companies involved in TAPS were, unfortunately, exacerbated by the lack of a clearly defined Federal role. The President's Decision directed that a limited and temporary restructuring of governmental enforcement authority over the ANGTS be implemented through a reorganization plan to vest such responsibilities with the OFI for the duration of the ANGTS project. Through the enactment of Reorganization Plan Number 1 of 1979, the Federal Inspector was given authority to schedule and expedite Federal agencies' permits, to review and approve the design and final cost estimate, and enforce all Federal permits and other authorizations. As per Executive Order No. 12142, the Reorganization Plan became effective on July 1, 1979, to remain in effect until 1 year after initial operation of the completed pipeline system.

Key regulatory actions occurred throughout the latter half of 1979 as the pipeline companies sponsoring the ANGTS continued with engineering design and construction planning. In June 1979, the Department of the Interior (DOI) conditionally authorized the Right-of-Way grant for construction across Federal lands in Alaska. In August, the FERC approved a 48-inch pipe size and 1260 psig pressure for the Alaskan segment, and in September, issued its final, unappealable incentive rate of return and tariff order.

Despite the progress made toward satisfying regulatory requirements, critical governmental actions, such as the determination of gas conditioning plant ownership, were not resolved as quickly as had been expected. Furthermore, the Northwest Alaskan Pipeline Company was beginning to run into difficulties in securing the massive financing required to build the Alaskan segment of the system. As a result, in late 1979, the system completion schedule was again revised; the November 1984 date was slipped one year to November 1985.

In 1980 the focus of project activity was on clearing the way for the start of construction on the prebuild segments in Canada and the lower 48 States, the completion of which had been targeted for late 1981. In January, the FERC issued the certificate for the Western Leg prebuild, subject to rehearing, and later in the same month, upgraded the diameter for the Western Leg pipe from 36 to 42 inches. On April 28, 1980, the FERC certified Eastern Leg prebuild construction at an estimated cost of $1.2 billion. While the United States had been issuing regulatory approvals to begin the prebuild, the Canadian regulatory authorities would not approve their portion of the prebuild system until assurances were received from the U.S. Government as to the financeability and timely completion of the full system in the United States. In July 1980, following written assurances from President Carter and a Joint Resolution of Congress (S.J. 104), the Canadians approved their portion of the prebuild system. Phase I construction began on the Canadian section in August 1980 under the auspices of Foothills Pipe Lines Ltd., and the new Canadian regulatory agency, the Northern Pipeline Agency (NPA), counterpart of the OFI.

As prebuild construction issues were being resolved, work on the regulatory approvals, financing, and complex engineering needed for the Alaskan segment continued throughout the latter half of 1980. In June, a cooperative agreement was signed by the pipeline sponsors and the North Slope gas producers for financing $500 million in design and engineering work. A statement of intent to develop a financing plan for construction was also signed. In July, Northwest Alaskan filed a partial application for a final certificate with the FERC and applied to the DOI for a Right-of-Way permit. Shortly thereafter, the Northwest Pipeline Corporation, in September 1980, began construction on its Western Delivery System, 350 miles and 30-inch looping from Stanfield, Oregon to Burley, Idaho, to take additional Albertan gas from the ANGTS Western Leg to markets in southern California. The Western Delivery System was related to, but not part of, the ANGTS project; construction on it was completed in May 1981.

During 1980 the OFI increased its staff and opened field offices in Alaska, California, and Nebraska to accommodate the expansion of project activity and to prepare for on-site construction on the prebuild line. The Agency was actively involved in coordinating permit issuances to expedite construction planning and operations; reviewing the sponsors' cost estimates in conjunction with the FERC; leading an arctic engineering board to assess and resolve difficult construction issues, such as frost heave; analyzing the Alaskan Right-of-Way application; monitoring field work on borehole drillings along the pipeline corridor in Alaska; and providing technical advice on major pipe and related procurements. The OFI also developed solid working relationships with other Federal agencies, State and local groups, and the Government of Canada so that all concerns were addressed early and adequately, thereby keeping construction on an expedited track.

By the end of 1980 several key project milestones were met. On November 29, 1980, DOI issued the Right-of-Way grant to the Northwest Alaskan Pipeline Company, following Congressional approval on the 19th of November. On December 8, 1980 the OFI issued a Notice to Proceed to the Pacific Gas Transmission Company giving the company the green light to proceed with Western Leg prebuild construction, which began that same day in Idaho. Two days later, on December 10, 1980, a group of 28 U.S. and Canadian banks signed agreements with the Northern Border Pipeline Company to provide a loan of $1.055 billion for construction of the first phase of the Eastern Leg. A consortium of nine U.S. commercial banks led by Bankers Trust Company had already agreed to loan up to $160 million to Pacific Gas Transmission Company for prebuild construction on the Western Leg; Pacific Gas financed the remainder of the cost through the sale of common stock.

Construction progressed smoothly on the Western Leg prebuild, which was completed, aside from some minor compressor modifications and revegetation, at the end of September 1981. Gas from Canada began flowing through the Western Leg in October 1981. The segment had been constructed on schedule and under budget.

Construction on the Eastern Leg prebuild began in April 1981, after a series of events had transpired to extend the target completion date from late 1981 to the fall of 1982. A major reason for the delay was a lawsuit filed by the OFI and the FERC against the Public Service Commission of the State of North Dakota, which had, on September 12, 1980, denied the Eastern Leg sponsors a permit to cross the State within the corridor previously approved by the Federal Government. On April 2, 1981 the U.S. District Court for North Dakota granted a motion for summary judgment in favor of the OFI and the FERC, thereby allowing work to proceed on the segment. The Notice to Proceed enabling construction to begin in May on six spreads in Montana, South Dakota, Minnesota, and Iowa was issued by the OFI on April 18, 1981. By September 1981, 58% of the Eastern Leg had been constructed.

Continued delays in obtaining financing for the Alaskan segment forced another schedule slippage such that the full system completion date was changed, in June 1981, from the winter of 1985-86 to 1986-87. Financing, which had to be in place by mid-1981 to permit the sponsor to place orders for major materials and equipment to meet the 1985-86 target date, was still eluding the sponsors. Because the risks involved in Alaskan construction translated into significantly higher costs than those for the other, more routine segments of the system, it was taking longer than anticipated to secure financing for the Alaskan Leg. Compounding the problem was the provision of law prohibiting the producers of Alaskan gas (Exxon, Arco, and Sohio) from having equity in the pipeline, effectively cutting off a major source of capital investment.

In the meantime, the pipeline consortium and the major gas producers reached agreement on the need for waivers of law that would permit equity participation by the producers in financing the Alaskan Leg. Following up on this agreement, John McMillian, Chairman of Northwest Alaskan Pipeline Company, sent a letter to President Reagan in June 1981, requesting consideration of a series of waivers of law to enable private financing. Later, to facilitate private financing and expeditious project completion, President Reagan invoked the provision of ANGTA which permitted waiving laws found to be inhibiting progress on the ANGTS.

On October 15, 1981, President Reagan transmitted a waiver proposal to Congress which contained the following key requests:

- to allow the producers to participate in the ownership of the Alaskan segment, subject to FERC approval;

- to include the gas conditioning plant as part of the approved transportation system to be certificated by the FERC, without the Incentive Rate of Return requirements;
- to remove the evidenciary hearing requirement from the FERC process, leaving the use of such hearings to the FERC's discretion;
- to assure that, once approved by the FERC, the charges for actual operation and maintenance, actual current taxes, and amounts to service debt (minimum bill) of the ANGTS tariff, or recovery of those charges by the purchasers of Alaskan gas, could not be changed by a subsequent FERC decision;
- to permit the Canadian sponsors to recover the full cost-of-service upon completion of the Canadian portion, but not before the operation date determined by the FERC; and
- to permit the Alaskan sponsors to recover the minimum bill charges upon completion of either the Alaskan Leg or the gas conditioning plant, but not before a date certain to be determined by the FERC during the final certificate processing.

After the appropriate committees considered the waiver request, Congress approved on December 10, 1981, via Joint Resolution, all the amendments proposed by President Reagan. Approval of the waivers provided a regulatory framework permitting the sponsors to pursue private financing with greater chance of success.

Most of the OFI's efforts in 1981 were geared to oversight of lower 48 construction, and review of engineering design and environmental plans for the Alaskan Leg. Both the Omaha and San Francisco field offices established smaller construction offices along the pipeline route to ensure adequate coordination and oversight of the sponsors' activities. The thoroughness and responsiveness of the lower 48 field effort helped to assure steady progress on prebuild construction, and speedy resolution of the few problems that arose. As a result, the Western Leg was built on time and slightly under budget.

The OFI engineering and environmental review programs assisted in technical matters concerning the prebuild system, but the focus of their efforts was on Alaskan Leg design review and related arctic construction issues. These staffs worked closely with the sponsor in the development of design criteria manuals and schedules for review of engineering and environmental design packages. The results of the frost heave tests and Atigun Pass borehole drillings were analyzed with the expectation of developing design strategies to minimize pipe displacement in the frozen soil and structural problems in the narrow Atigun Pass. The environmental staff completed its review of the sponsor's draft plans on clearing, restoration, wetlands construction, and quality assurance, and continued its review of the sponsor's studies on endangered species and fisheries.

In conjunction with the Alaskan design review effort, the OFI Alaska field office staffs performed on-site monitoring of the sponsor's field data gathering and survey programs. The Alaska offices monitored the sponsor's drilling program, which covered 5,000 boreholes. As part of its continuing responsibility to expedite permitting, the Alaska office also coordinated the issuance of 40 Temporary Use Permits through the "one-window" process.

The major project activities that occurred during the first half of 1982 included continued construction on the Eastern Leg prebuild, design of the Alaskan Leg segment, and negotiations on financing.

Despite passage of the waivers, Alaskan Leg financing was still not within immediate reach. Due to the short term excess world energy supplies, depressed crude oil prices, and uncertainties in world financial markets, the sponsors of the Alaskan Leg concluded in the spring of 1982 that they would need more time to secure the financing than the 1986-87 completion date allowed. On April 30, 1982, the sponsors revised the construction schedule projecting a system completion date of 1989-90, based on obtaining financing by mid-1984. Alaskan construction was postponed two years in the hopes that general economic and specific energy market conditions would settle enough over time to allow financing of the gas pipeline project by 1984.

Not only did Northwest Alaskan revise its construction schedules, but it also quickly and substantially reduced its staffing and contract support shortly after the April 30th announcement. At that time, its staffing was cut about 48%, down to 138 employees, and its contractor support by approximately 90%, down to a total of 50 employees. In spite of the reductions, the sponsors continued to work on the design criteria packages for both the pipeline and the gas conditioning plant.

At the end of August 1982, construction of the Eastern Leg prebuild was essentially completed, aside from some minor restoration work. Gas from Canada began flowing through the Eastern Leg on September 1, 1982. Despite some welding problems, the segment was completed under budget and on time.

With the completion of the Eastern Leg, 1,512 miles, or 32% of the total ANGTS system had been constructed. Of that total, 983 miles were in the U.S. and 529 in Canada. The prebuild system was now the longest, most expensive gas pipeline ever built at one time in the lower 48. That both prebuild segments were completed within budget and basically on schedule is due in part to the expeditious oversight of the OFI field inspection staff, along with the highly cooperative efforts of the sponsor companies and other Federal agencies.

Because of the slippage in the construction schedule to a 1989-90 completion date, the OFI began to cut back its staffing and workload plans to reflect the hiatus in major project activity between the first and second phases of ANGTS construction. All along, the OFI had relied upon the workload estimates and construction schedules provided by the sponsors to develop its own planning. When Northwest Alaskan immediately reduced its operations, the OFI quickly reassessed its resource needs and began planning to cut the staff from a peak of approximately 159 total employees to 101 by the end of FY 1982. Employment reductions were planned in phases to accommodate any possible sudden upturns in project activity and to retain enough expertise to complete work on the prebuild and other vital design, environmental and cost analysis work that remained.

As 1982 progressed and other project developments were taken into consideration, Northwest Alaskan started to refine workload projections and short-range schedules for 1983, such that further reductions were indicated. The OFI cut back its funding and staffing accordingly and, in November 1982, projected that its budget could be reduced to approximately $6 million and its staff to approximately 40 employees by the end of FY 1983. The timing of the OFI's reductions were based on the premise that most of the design criteria review, audit, and permitting work on the last items submitted by Northwest Alaskan could be completed by mid-1983. After that and the conclusion of post-construction work on the Eastern Leg prebuild system, OFI work would be limited to some technical analyses and updates; review of the sponsor's environmental and technical plans; advance planning for Phase II; liaison with the sponsor, State and local groups, and the Canadians; and essential administrative and management functions to keep the agency operating smoothly.

I would now like to discuss the latest developments in the pipeline project and the current outlook for its eventual completion.

Northwest Alaskan, after its spring 1982 announcement on the slippage to a 1989-90 completion date, has steadily reduced its staff, although it has continued to pursue a variety of biological, physical and civil projects along the pipeline corridor, all under OFI review. As for the OFI's total staff, it dropped to a total of 26 employees by September 30, 1983. The Omaha field office, operations center for Eastern Leg oversight, closed in April 1983. Although small staffs remain in Anchorage and Irvine, where the engineering staff is located, most of the OFI's personnel are located in Washington, D.C. Staff continues to complete permitting, design review, cost auditing and enforcement responsibilities, while monitoring a host of sponsor technical studies such as on frost heave, and removal of carbon dioxide from the gas stream. The OFI recently received its FY 1984 appropriation of $2,963,000, which is based on a workforce of approximately 30 positions.

On May 9, 1983, Phase I construction in Canada was completed by Foothills, the Canadian sponsor consortium. Afterward, Foothills cut its staff and the NPA followed suit, trimming its roster to 28 full-time equivalent positions by layoffs and temporary reassignments. At this time, the NPA plans to reduce its staff to the equivalent of 15 employees by the spring of 1984.

Operations on the prebuild segments have continued to run smoothly, although, because of marketing problems, gas flows now represent only about 40 percent of the volumes available for export under existing contracts. Northwest Alaskan Pipeline Company has just negotiated interim purchase agreements with Pan Alberta, reducing its minimum take obligation through October 1984 to 40 percent of contracted capacity. Additional efforts are underway to lower the delivered cost of the Phase I gas to improve its marketability.

As mentioned previously, the latest announced schedule still calls for system completion in late 1989. While it is still theoretically possible to maintain that schedule, the sponsors' ability to make the necessary commitments for the procurement of equipment and materials depends on the progress that is made toward obtaining the necessary gas sales contracts and financing. Little progress has been made in this area due to current conditions in the energy markets.

At the last partnership meeting, held in October 1983, the partnership authorized expenditures for the fourth quarter of 1983. At this time, Northwest Alaskan has about 50 employees, including contractor personnel; they plan to maintain this level during the fourth quarter. The OFI's authorized strength is now 30 employees, which represents our core workforce; however, because of unanticipated departures, we currently have only 26 employees. We are exploring ways to fill the employment gaps to be sure there will be no sacrifice in the accomplishment of our critical functions.

On September 20, 1983, Northwest Energy Company, parent of Northwest Alaskan Pipeline Company, and the Williams Companies announced the execution of a merger agreement under which Williams Companies would acquire, for cash, all the outstanding shares of common stock of Northwest Energy. Subsequently, John McMillian was replaced as Chairman of Northwest Energy by Joseph H. Williams; Vernon T. Jones, who will continue as an Executive Vice President and Director of Williams Companies was named President and Chief Executive Officer of Northwest, as well as the principal executive of Northwest Alaskan Pipeline Company.

I have been informed by Mr. Jones in writing that Northwest Energy Company and the Williams Companies will actively support and provide leadership to the ANGTS project, and that no significant changes in Northwest's stewardship of the project are planned. Northwest Alaskan is expected to continue as operator for the sponsoring partnership and the Design and

Engineering Board. Mr. Jones also stated that the project has been brought to a relatively advanced stage of planning so that it could be implemented without significant delay when economic conditions are appropriate.

Much has been accomplished to assure that the Alaskan Leg can move forward at the appropriate time:

- ° The sponsors have revised and submitted 29 of 31 sections of the pipeline Design Criteria Manual to the OFI. The OFI has reviewed and approved 28 of them. The remaining three sections are expected to be approved by the end of 1984, including the final approval of frost heave methodology.

- ° Ten of 25 environmental and construction procedure plans required by the DOI Right-of-Way grant have been given final approval; 10 more are being prepared, revised or are under review, and are expected to be completed in 1984. Five have been deferred until remobilization.

- ° In early June 1983, the sponsors submitted their proposed approach for the prediction and mitigation of frost heave to OFI for review. The OFI has reviewed the submission, assisted by the Cold Regions Engineering Technical Committee, and, in September, conditionally approved the approach, subject to certain additional testing.

- ° In early July 1983, the sponsors submitted an analysis of a new process and design for the Alaska Gas Conditioning Facility. In September, OFI approved the use of the new process and approved the proposed design for procurement and further detailed design work. The new design will reduce the cost of the conditioning facilities by about 25 percent, or $1 billion, and also eliminates the need for 1 of the 3 previously planned sealifts.

- ° The FERC has issued orders on the Certification Cost Estimate and Shipper Tracking, thus completing its work on all pending issues related to the Alaskan Leg, except for the conditioning plant cost estimate which has been deferred at the sponsor's request. The DOI Right-of-Way grant has also been issued.

We believe that construction of the second phase of the ANGTS system could begin about 2 years after an order to remobilize. The key steps necessary to a remobilization are:

1. Rehiring of a project team.

2. Completion of frost heave work, field investigations, Design Criteria review, and the engineering "bridge" needed between the Design Criteria and the Final Design effort.

3. Completion of the Final (70 percent) Design work.

4. Submission of gas sales contracts, financing plans and marketability studies to FERC, and receipt of the Final Certificate of Public Convenience and Necessity.

5. Approval of a Right-of-Way grant from the State of Alaska.

In summary, all major regulatory work has been done except the final FERC certification, which will require financing plans, gas contracts, marketability studies, and a Right-of-Way grant by the State of Alaska. The basic engineering is almost complete to begin the Final Design. The solution to the frost heave problem is close at hand, and the sponsors have a good program to complete this basic engineering work.

The ANGTS project has thus reached the point where it can proceed expeditiously to construction. Plans have been developed to the point where costs should be well controlled and the project well engineered.

Mr. Chairman, that concludes my prepared statement. I will be happy to answer any questions you may have.

Senator **Murkowski**. Thank you, Mr. Rhett.

The next witness, Mr. Jan Mares, Acting Director, Office of Policy, Planning and Analysis, and Assistant Secretary of Fossil Energy, Department of Energy.

STATEMENT OF HON. JAN W. MARES, ACTING DIRECTOR, OFFICE OF POLICY, PLANNING AND ANALYSIS, AND ASSISTANT SECRETARY, FOSSIL ENERGY, DEPARTMENT OF ENERGY

Mr. **Mares**. Thank you Mr. Chairman.

I am pleased to have this opportunity to discuss the alternatives for marketing Alaskan natural gas. As you know, the U.S. Government, pursuant to its agreement with the Government of Canada, has supported the ANGTS based on the principle of private financing. Consistent with this principle the United States has pledged to and, in fact, has removed legal or regulatory barriers that would inhibit or prevent private interests from proceeding with the development of ANGTS.

At this moment in time, the United States currently has a surplus deliverability of natural gas that's estimated to be between 2 and 4 trillion cubic feet. However, in the longer term, additional supplies of natural gas are expected to be needed certainly in the United States, and in the addition, there is an anticipated long-term need for additional natural gas supplies on the world market. Both the United States and the world market could provide potential markets for Alaskan gas.

The issue is not whether markets for Alaskan gas would be available, but when they will provide demand at a price which would justify the enormous investments required to bring this gas to market. This is a question that's best left to the judgment of private commercial interests, and not to the Government. Changes in the energy market have affected the timetable for the ANGTS project. Witnesses who are involved in that project will be testifying here and can best estimate when the project will be completed and its status. The U.S. consortium, as you know, is headed by a new sponsor. We understand that the participants are fully committed to proceed with the completion of the project and are working to achieve that result. We are encouraged by this view, and will continue our commitment to the ANGTS, as we have in the past.

You are also hearing today from representatives of some investors and developers who have expressed interest in the possibility of other pipeline routes and the export potential for Alaskan gas. In connection with these and other proposals, decisions about the development of Alaska's gas resources must be made by investors and commercial parties based on the facts about the supply and demand for natural gas. It is the administration's desire to encourage companies to make investment decisions consistent with their best economic judgments. We will not take action that would stand in the way of activities to successfully and economically develop Alaska's gas resources.

I will stop at this stage and turn it over to my other panel member, Mr. Wendt.

[The prepared statement of Mr. Mares follows:]

STATEMENT OF JAN W. MARES
ACTING DIRECTOR, OFFICE OF POLICY, PLANNING, AND ANALYSIS
ASSISTANT SECRETARY FOR FOSSIL ENERGY

Mr. Chairman and Members of the Committee:

I am pleased to have this opportunity to discuss alternatives for marketing Alaskan natural gas. As you know, the goal of this Administration's policy, as described in our recent National Energy Policy Plan, "is to foster an adequate supply of energy at reasonable cost." The strategies we have adopted for pursuing this goal are first, to minimize federal control and involvement in energy markets; and second, to promote a balanced mixed energy resource system.

The NEPP further notes that this country's resources are sufficient to ensure a secure, diverse mix of energy supply well beyond the year 2000 and that the timely, economic development of these resources will be determined, in part, by how well federal programs--in particular, leasing of public lands and the Outer Continental Shelf--support private initiatives and investment in exploration and development activities. For purposes of today's hearing, the energy policy point I want to emphasize is that the timing and economics of developing Alaska's resources are issues which private commercial interests should and will decide.

Gas resources in the State of Alaska represent a significant source of future energy supply. About 26 trillion cubic feet of recoverable gas has already been discovered on the North Slope. The potential for additional discoveries is extremely high. A 1981 study by the National Petroleum Council estimates that potentially recoverable gas resources in the U.S. Arctic total approximately 109 TCF. If and when exploration converts significant portions of this potential into recoverable resources, the amount of natural gas available from on and offshore Alaska could be sufficient to serve both domestic and international demand for natural gas.

The development and marketing of Alaskan gas resources, however, present formidable engineering and transportation challenges and will require tens of billions in private capital. Three billion dollars already have been invested by American and Canadian companies in the transportation system approved by both governments for bringing North Slope gas to the U.S. markets. This project, the Alaska Natural Gas Transportation System (ANGTS), has been in the development stage since 1976.

It has been undertaken pursuant to a series of actions, beginning with the 1977 Transit Pipeline Treaty and the U.S.-Canadian Agreement on the Alaska Natural Gas Transportation System, whereby the governments of the United States and Canada have mutually agreed to facilitate the construction and operation of ANGTS. There have been continuing Presidential and Congressional actions in support of the project.

In 1980, the Congress adopted a resolution declaring, in part, that ANGTS remains, "... an essential part of securing this Nation's energy future and enjoys the highest level of Congressional support for its expeditious construction and completion ..." Later that year, President Carter wrote to Prime Minster Trudeau reconfirming the U.S. Government's commitment to the ANGTS project and indicating his willingness to initiate action before the Congress to remove legal impediments to private financing for ANGTS.

Based on these assurances by Congress and the President, the Canadian government authorized construction of the Canadian portion of the southern legs of the system -- the so-called "prebuild" sections. The prebuild was constructed to allow Canadian gas to be brought to U.S. markets in the Midwest and on the West Coast, thereby facilitating financing of the ANGTS project. Construction of the prebuild has been largely completed, and gas from Canadian wells is now flowing through these lines to U.S. markets.

President Reagan has continued the earlier commitments of this government to ANGTS. In March, 1981 he addressed the Canadian Parliament, describing ANGTS as "... one of the largest joint private projects ever undertaken by two nations ..." and stating that, "we strongly favor prompt completion of this project based on private financing." In a message to Congress on October 15, 1981, he reiterated his support for completion of the project based on private financing, and he emphasized the importance of the project as "a symbol of U.S.-Canadian ability to work together cooperatively in the energy area for the benefit of both countries and peoples."

The United States Government, pursuant to its agreement with the Government of Canada, has supported the ANGTS based on the principle of private financing. Consistent with this principle, the U.S. pledged to remove legal or regulatory barriers that would inhibit or prevent private interests from proceeding with the development of ANGTS.

In fulfillment of this pledge, President Reagan proposed waivers of law which were approved by Congress on December 15, 1981. Since then, we have continued to cooperate fully with the Canadian government in matters involving ANGTS. In this connection, we will engage later this month in formal consultations, as requested by Canada, on policy and regulatory issues involving the prebuild section of ANGTS.

As members of this Committee are well aware, the energy market has changed considerably since 1977. Current demand for energy is lower than what was projected at that time, and energy prices have not increased to the levels then anticipated. These facts are true for the United States; they also are true for world energy markets.

In terms of natural gas, the United States currently has a surplus deliverability of natural gas estimated to be about 2 to 4 trillion cubic feet. If, as this Administration believes is critically necessary, the Congress acts to decontrol natural gas prices, the U.S. gas market will come into balance, and the current surplus will be eventually eliminated, probably over the next several years. Over the longer term, additional supplies of natural gas are expected to be needed. In addition, the anticipated long-term need for additional natural gas supplies on the world market could provide potential foreign markets for Alaskan gas.

The issue is not whether markets for Alaskan gas will be available, but when they will provide demand at a price which will justify the enormous investments required to bring this gas to market. This is a question best left to the judgment of private commercial interests, and not to the government.

Changes in the energy market have affected the timetable for the ANGTS project. Witnesses who are involved directly in the ANGTS project and will testify at today's hearing can best estimate when the system will be completed. The U.S. consortium is headed by a new sponsor. We understand that the ANGTS participants are fully committed to proceed with completion of the project and are working to achieve that result. We are encouraged by this view, and will continue our commitment to the ANGTS as we have in the past.

You are also hearing today from representatives of some investors and developers who have expressed interest in the possibility of other pipeline routes and the export potential for Alaskan gas. In connection with these and other proposals, decisions about the development of Alaska's gas resources must be made by investors and commercial parties based on the facts about the supply and demand for natural gas. It is the Administration's desire to encourage companies to make investment decisions consistent with their best economic judgments. We will not take action that would stand in the way of activities to successfully and economically develop Alaska's gas resources.

In general, we agree with the NPC's finding in its report on U.S. Arctic Oil and Gas that, "the volume of economically recoverable gas would likely increase substantially if existing or planned production and/or transportation systems are in place and available at the time of development ..."(emphasis added). Our position in this regard is consistent with the principles underlying our commitment to the ANGTS system.

This concludes my formal statement, Mr. Chairman. I will be happy to respond to the Committee's questions.

STATEMENT OF HON. E. ALLAN WENDT, DEPUTY ASSISTANT SECRETARY FOR INTERNATIONAL ENERGY AND RESOURCE POLICY, DEPARTMENT OF STATE

Mr. WENDT. Mr. Chairman, I, too, appreciate the opportunity to be here this afternoon to discuss the development of one of this country's major untapped sources of energy, and that is the tremendous reserves of natural gas found in the North Slope area of the State of Alaska. In these times of world oil and gas surpluses, it is perhaps easy to overlook the need to press forward with commercial development of our own energy resources.

This administration has already made a major effort to remove regulatory impediments to the development of Alaskan gas. There is no doubt that gaining access to reserves which amount to some 13 percent of total proven U.S. gas reserves would contribute materially to both United States and overall Western energy security. We are concerned, Mr. Chairman, that the private development of North Slope gas proceed as soon as it is economical.

In 1981, President Reagan continued the earlier commitments of this Government to remove regulatory impediments to the private financing of the ANGTS project. It should be clear to all that it has been and remains the policy of this administration to support the ANGTS project based on private financing. At the same time, it would not seem reasonable for the administration to stand in the way of private sector efforts to develop other feasible options. In order to examine other possible options more fully, the United States-Japan Energy Working Group, which was created last January by President Reagan and Prime Minister Nakasone, has explored the market for LNG in Japan and the costs involved in getting gas from the North Slope to Japan. The Japanese have told us that, like the U.S. market, the Japanese gas market is saturated at this time. That is to say, they have commitments to meet their expected LNG needs through the early 1990's. By the mid-1990's, however, there could be a substantial supply-and-demand gap in Japan which Alaskan gas might fill if it is price competitive.

As you have noted, Mr. Chairman, last Friday, November 11, the President and the Prime Minister of Japan released a statement in Tokyo on bilateral energy cooperation. That statement said in part:

> The United States and Japan will encourage private industry in both countries to undertake now the prefeasibility or feasibility studies necessary to determine the extent to which Alaskan natural gas can be jointly developed by United States and Japanese interests.

Mr. Chairman, let there be no doubt that we maintain our previous commitments to the ANGTS project based on private financing and development and that we recognize fully that considerable resources have already been expended to bring the project to fruition. At the same time, we do note that the President and Prime Minister Nakasone agreed in Tokyo to encourage United States and Japanese private industry to explore the potential for joint development of Alaskan gas resources.

In sum, Mr. Chairman, we believe that as a government we are doing everything reasonable and appropriate to promote the private development of Alaskan gas in the interest of all parties. Ultimately the decisions and choices of the private sector will determine how and when Alaskan natural gas resources are developed and brought to market.

[The prepared statement of Mr. Wendt follows:]

TESTIMONY OF

E. ALLAN WENDT

DEPUTY ASSISTANT SECRETARY OF STATE

FOR INTERNATIONAL ENERGY AND RESOURCE POLICY

It is a pleasure to be here this afternoon to discuss the development of one of this country's major untapped sources of energy -- the tremendous reserves of natural gas found in the North Slope area of the State of Alaska. In these times of world oil and gas surpluses, it is perhaps easy to overlook the need to press forward with commercial development of our own energy resources. Energy security, however, requires continuing vigilance and Alaskan gas has an important role to play in our energy security considerations. Both the Williamsburg Summit Declaration in June and the conclusions of the Ministerial meeting of the International Energy Agency in May of this year highlighted the importance we attach to the early development of indigenous energy resources in the interest of enhancing Western energy security.

This Administration has already made a major effort to remove regulatory impediments to the development of Alaskan gas. There is no doubt that gaining access to reserves which amount to some 13% of total proven U.S. gas reserves would contribute materially to both U.S. and overall Western energy security.

It is with this objective in mind that the United States has worked closely with the Government of Canada for nearly a decade to provide the proper framework for the private

DEVELOPMENT OF NORTH SLOPE ALASKAN GAS RESOURCES AND THE COMPLETION OF THE ALASKA NATURAL GAS TRANSPORTATION SYSTEM. THE ANGTS, AS YOU WILL RECALL, WAS CHOSEN IN 1977 BY PRESIDENT CARTER AND APPROVED BY THE CONGRESS AS THE BEST OF THREE ALTERNATIVES TO BRING NORTH SLOPE GAS TO THE U.S. MARKET. A TREATY WAS NEGOTIATED WITH CANADA TO ENSURE A STABLE REGULATORY AND ECONOMIC ENVIRONMENT. FINALLY, PRESIDENT CARTER PROMISED THE CANADIANS IN WRITING THAT WE WOULD REMOVE THE REGULATORY IMPEDIMENTS TO THE PRIVATE FINANCING OF THE PROJECT.

IN 1981, PRESIDENT REAGAN CONTINUED THE EARLIER COMMITMENTS OF THIS GOVERNMENT TO THE ANGTS PROJECT, BASED ON PRIVATE FINANCING, BOTH IN DIRECT COMMUNICATION TO THE CANADIAN PARLIAMENT AND THROUGH THE ADMINISTRATION'S SPONSORSHIP OF LEGISLATION TO OBTAIN THE LEGAL WAIVERS NECESSARY FOR THE ANGTS PROJECT TO PROCEED. IN SO DOING, HE FOLLOWED UP ON OUR COMMITMENT TO REMOVE REGULATORY IMPEDIMENTS TO THE PRIVATE FINANCING OF THE PROJECT. IT SHOULD BE VERY CLEAR TO ALL THAT IT HAS BEEN AND REMAINS THE POLICY OF THIS ADMINISTRATION TO SUPPORT THE ANGTS PROJECT BASED ON PRIVATE FINANCING.

THERE CAN BE NO DENYING, HOWEVER, THAT DESPITE THE BEST EFFORTS OF THE U.S. GOVERNMENT TO REMOVE LEGAL AND REGULATORY OBSTACLES, PRIVATE FINANCING NECESSARY TO COMPLETE THE ANGTS

PROJECT HAS NOT YET BEEN FORTHCOMING. WE CAN SPECULATE ABOUT THE REASONS FOR THIS STATE OF AFFAIRS, BUT CLEARLY, THE CURRENT GAS DELIVERABILITY SURPLUS IN THE U.S. AND THE UNCERTAIN PRICING CONDITIONS THIS SURPLUS HAS CREATED HAVE LED BANKS AND INVESTORS TO BE CAUTIOUS. WHETHER THE U.S. GAS MARKET WILL CHANGE ANY TIME SOON IS A QUESTION WE CANNOT ANSWER AT THIS POINT.

IN ANY EVENT, AS A RESULT OF THESE UNCERTAINTIES, SOME PRIVATE BUSINESS INTERESTS HAVE BEEN LOOKING AT ALTERNATIVES FOR MARKETING ALASKAN GAS IN AREAS OUTSIDE THE U.S., SUCH AS JAPAN AND PERHAPS KOREA. SOME PRELIMINARY STUDIES HAVE EXAMINED THE POTENTIAL FOR MARKETING NORTH SLOPE GAS IN JAPAN IN THE MID-1990S.

WE ARE CONCERNED THAT PRIVATE DEVELOPMENT OF NORTH SLOPE GAS PROCEED AS SOON AS IT IS ECONOMIC. WE CONTINUE TO SUPPORT PREVIOUS COMMITMENTS TO THE ANGTS PROJECT BASED ON PRIVATE FINANCING. AT THE SAME TIME, IT WOULD NOT SEEM REASONABLE FOR THE ADMINISTRATION TO STAND IN THE WAY OF PRIVATE SECTOR EFFORTS TO DEVELOP OTHER FEASIBLE OPTIONS. SUCH A POSTURE, MOREOVER, IS IN KEEPING WITH THE ADMINISTRATION'S PHILOSOPHY OF SEEKING TO REMOVE REGULATORY OBSTACLES TO PRIVATE SECTOR INITIATIVES TO DEVELOP THE NATION'S ENERGY RESOURCES.

In order to examine other possible options more fully, the U.S.-Japan Energy Working Group, created last January by President Reagan and Prime Minister Nakasone, has explored the market for LNG in Japan and the costs involved in getting gas from the North Slope to Japan. The Japanese have told us that like the U.S. market, the Japanese gas market is saturated at this time; that is, they have commitments to meet their expected LNG needs through the early 1990's. By the mid-1990's, however, there could be a substantial supply gap in Japan which Alaskan gas might fill if it is price competitive.

As you may be aware, Mr. Chairman, just last Friday, November 11, the President and the Prime Minister of Japan released a statement in Japan on bilateral energy cooperation. That statement said in part, "The U.S. and Japan will encourage private industry in both countries to undertake now the pre-feasibility or feasibility studies necessary to determine the extent to which Alaskan natural gas can be jointly developed by U.S. and Japanese interests."

Some private sector interests have suggested the concept of a Y-shaped system; that is, a common pipeline from the North Slope to Fairbanks and then separate legs -- one for the ANGTS system and one toward a tidewater LNG plant, the assumption being that there is probably enough gas in Alaska over and above the known proven North Slope reserves of 26 TCF to serve both the U.S. and other Pacific-rim markets. We have not tried to assess the economic viability of such a plan, but neither have we reached the conclusion that an LNG project and the ANGTS project are incompatible.

All this being said, however, there are no cost-effective means under current market conditions to develop North Slope gas reserves. Reinjection costs are high and rising. Further, without a commercial market there is limited incentive for the companies to explore further for gas, the vast potential of which therefore remains unrealized.

I want to assure the Committee we in the Administration have not lost sight of the important benefits to the State of

ALASKA, THE U.S., AND THE WESTERN ALLIANCE THAT WILL STEM FROM DEVELOPMENT OF NORTH SLOPE GAS. LET THERE BE NO DOUBT THAT WE MAINTAIN OUR PREVIOUS COMMITMENTS TO THE ANGTS PROJECT BASED ON PRIVATE FINANCING AND DEVELOPMENT, AND THAT WE RECOGNIZE THAT CONSIDERABLE RESOURCES HAVE ALREADY BEEN EXPENDED TO BRING THE PROJECT TO FRUITION. AT THE SAME TIME, WE NOTE THAT THE PRESIDENT AND PRIME MINISTER NAKASONE AGREED IN TOKYO TO ENCOURAGE U.S. AND JAPANESE PRIVATE INDUSTRY TO EXPLORE THE POTENTIAL FOR JOINT DEVELOPMENT OF ALASKAN GAS RESOURCES.

IN SUM, WE BELIEVE THAT AS A GOVERNMENT WE ARE DOING EVERYTHING REASONABLE AND APPROPRIATE TO PROMOTE THE PRIVATE DEVELOPMENT OF ALASKAN GAS IN THE INTEREST OF ALL PARTIES. ULTIMATELY, THE DECISIONS AND CHOICES OF THE PRIVATE SECTOR WILL DETERMINE HOW AND WHEN ALASKAN NATURAL GAS RESOURCES ARE DEVELOPED AND BROUGHT TO MARKET.

Senator MURKOWSKI. Thank you, Mr. Wendt.

Just a few brief questions. Mr. Rhett, what is the status of your office currently? It's summarized by some that you appear to be closing up shop.

Mr. RHETT. Well, let's say we're getting close to the bottom. The size of our shop is a function of the workload and, as you know from the past, I have cut back on staff as the workload decreased. We're actually down to about 26 in four separate locations. The Irvine, Calif., office is where we're working with the engineering element of Northwest. There are presently four people there.

In Alaska, the Anchorage office has six people, with two in Fairbanks who are liaisons to the State of Alaska and Northwest.

This is the core staff needed to keep up with the sponsor's workload and to remobilize.

Senator MURKOWSKI. And your budget currently in the 1983 fiscal year?

Mr. RHETT. We are presently at about $6 million.

Senator MURKOWSKI. And 1984 is projected to be?

Mr. RHETT. We're into 1984 now, and that will be a little under $3 million. The budget for 1983 was about $6 million, but we did not spend that much.

Senator MURKOWSKI. The data you have accumulated over the last couple of years that's basic property of the Federal Government, the Office of the Federal Inspector, available to the project.

Mr. RHETT. Yes. It is to the project; however, a lot of the information the Government has is business confidential.

Senator MURKOWSKI. In the event as indicated by my opening remarks, and it will be brought out later in testimony, if there were another proposal that was seriously considered, would the Federal

Government have the opportunity to dispose of its information by selling it or is it available free or, what kind of arrangements might there be?

Mr. RHETT. Mr. Chairman, let me skirt this one because it's a highly legal matter which I am not qualified to answer, as an engineer. But quite a bit of the information is proprietary or business confidential. It's owned by the sponsors. It was provided to the Federal Government so that we could do the required reviews. But again, this information is protected and we do protect it. We have a separate setup to make sure that it is. The franchise right now under which I operate is strictly for the ANGTS by law.

Senator MURKOWSKI. I would like to talk a little bit about gas reserves and the responsibility of the Department of Energy to ascertain gas reserves.

It has been my understanding that the estimate has been about 26 trillion cubic feet proven reserves for Alaska. But I'm wondering, does the Department of Energy continually update those figures or is there any indication of what the reserves might currently be as a consequence of gas findings that are a direct result for continued oil exploration as has been the case in the North Slope of Alaska?

Mr. MARES. We periodically publish estimates. The Department itself does not do reserve estimates. The agency of the Government that has a greater responsibility for this is the U.S. Geological survey. We do collect that sort of information.

We did as a Department sponsor the request of the National Petroleum Council to do a study for us of the potential economically recoverable resource in Alaska and as I recollect, the estimate was that it was about 109 trillion cubic feet. That's a potential resource that doesn't become a recoverable reserve until in fact it is found and some of the development has been done. So my understanding is similar to yours, that there is today about 26 trillion cubic feet that is in the proven category, but there is a potential for substantially more.

Senator MURKOWSKI. Mr. Rhett, I would throw this at the panel. There has been a perception that the Alaska Natural Gas Transmission Act in 1976 and subsequent acts of Congress has promised Prudhoe Bay gas to the exclusion of all other possible users of the gas. From your vantage point of view, do you have a comment that in reality that is the case? And if not, is there a practical alternative in your opinion?

Mr. RHETT. I think really this is one Mr. Mares should answer.

Mr. MARES. I think your statement is accurate, that there is a generally held view that the gas on the North Slope proven reserves has in essence been committed to the ANGTS project.

Senator MURKOWSKI. Then I would refer to the last gentleman who hasn't had a chance to defend himself, in view of your comments, recognizing the recent communique that was negotiated governing energy policy between the United States and Japan that may be somewhat applicable to earlier as well, you seem to infer we could be officially looking at two projects here from the standpoint of the administration. And my question to you, are two projects in essence in conflict? But the fact that one in fact enjoys a franchise and the other appears to be in the embrionic stage, a formulation into a different marketplace. Does a different marketplace mean that the two could be looked at simultaneously or are you looking in effect to one?

Mr. **Wendt**. Mr. Chairman, the declaration that was issued in Tokyo encourages private industry in both countries to explore the potential for development of Alaskan North Slope gas resources and to undertake prefeasibility or feasibility studies. It really doesn't even address the question of whether or not, if these feasibility studies were to reach the point or take the form of a serious project, there might be some legislative obstacle.

I understand there is a view of the General Counsel of the Department of Energy which is in accordance, of course, with what Mr. Mares said, and I believe that is also the view of the Legal Adviser's Office of the Department of State.

Presumably, if the prefeasibility or feasibility studies are conducted and they indicate that they should be pursued, obviously the private sector sponsors of those studies would have to take a long hard look at whatever legislative obstacles there may be to pursuance of the project.

Senator **Murkowski**. As a followup, is it possible for the private sector to realistically attempt to develop Alaska gas, to explore it when the administration has maintained its continuing commitment to the ANGTS?

Wouldn't you agree that financial and market conditions are going to dictate, to some extent, the reality of one vis-a-vis the other? And Mr. Mares has not indicated whether in effect there's enough gas for two and we may get into that later. I hope we do, with some expert witnesses that have information.

We seem to have the administration posture, if you will, supporting both. Not specifically a gas liquefication project as much as the idea of working with our allies in the Pacific rim countries to see if it's feasible to market liquified natural gas from Alaska basically to do something about the deficit in the balance of payments, because I recognize they're not going to be able to do it with oranges.

Now by the same token, the administration has a commitment to back the ANGTS project. I assume what you're saying, Mr. Wendt, is you don't see the conflict because we're involved in the feasibility stage and as a consequence it's immaterial.

Mr. **Wendt**. Mr. Chairman, I don't see any conflict at this stage as I indicated. If those private sector interests that wish to pursue the development of Alaskan North Slope gas find through their studies that this proposal has merit and should be developed, I don't see any reason why they shouldn't push things that far. Obviously at some point, if that stage were reached, the question of legislative obstacles would have to be faced up to.

Senator **Murkowski**. So it's the service of doing business and it may be one or the other and it may be one or possibly both. So you don't see a conflict. All right, I appreciate that.

Mr. Mares, one other question. The communique that was referred to does specify that the United States will encourage the private sector specifically to undertake feasibility or prefeasibility studies of gas. What steps is the Department of Energy prepared to take to encourage or assist in these feasibility studies? Do you see it as part of your role?

Mr. **Mares**. We don't see that as part of our role. The decision and final analysis has got to be made by the private investors, and they are best equipped to decide the nature of the study and how they want to——

Senator **Murkowski**. The Department of Energy has made some progress in experimental areas before in regard to energy and I thought they would volunteer.

Mr. **Mares**. We've tried not to support those feasibility studies, sometimes with less success than we would like.

Senator **Murkowski**. I've noticed that. I don't know if I should urge that you stay out of this one, I see you're not openly volunteering.

I want to thank the witnesses. I think your opening statements have been pointed and your responses have been more than we expected, and with that I thank you and wish you good day, and would encourage your continued participation on this very important issue.

Additional questions may be submitted to you.

I will now call the second panel, and I find this one lonely gentleman from the State of Alaska, the Hon. Richard Lyon, commissioner of economic development from the State of Alaska, accompanied by Mr. Mark Wittow, Office of the Governor, State of Alaska.

I see, Mr. Lyon that Governor Hickle was glad to take your seat. It appears that the system is working.

Mr. **Lyon**. He also asked for a check, Mr. Chairman.

Senator **Murkowski**. Please proceed with your testimony. We certainly welcome you before the committee representing Governor Sheffield, the Governor of Alaska, and we understand that you are the proud owner of one-eighth of all the gas in existence in Alaska, is that correct?

Mr. **Lyon**. That is right, Mr. Chairman. I would hope that the owners of the other seven-eights help us along the way to getting all eight-eights merchandised.

Senator **Murkowski**. Christmas is coming, you know what they say about wishes.

STATEMENT OF RICHARD LYON, COMMISSIONER OF COMMERCE AND ECONOMIC DEVELOPMENT, STATE OF ALASKA, ACCOMPANIED BY MARK WITTOW, OFFICE OF THE GOVERNOR, STATE OF ALASKA

Mr. **Lyon**. Thank you, Mr. Chairman. I'm Richard Lyon, commissioner of the Alaska Department of Commerce and Economic Development. With me is Mark Wittow, associate director of the Alaska Governor's Office in Washington, D.C.

We appreciate the opportunity to present the views of the State of Alaska on the North Slope gas reserves to the Senate Energy Committee.

On behalf of Governor Sheffield we would like to thank you for holding these oversight hearings on a subject of vital concern to Alaska.

Development of the extremely large natural gas reserves found on Alaska's North Slope is clearly in the best interests of the nation and of Alaska. Those reserves, some 26 trillion cubic feet at

Prudhoe Bay—the equivalent of 4.5 billion barrels of oil—and several trillion cubic feet in adjacent fields, are a vital American energy resource. Encouraging the development of North Slope natural gas should be a component of national energy policy.

The State supports any project that can reasonably offer the prospect of bringing Alaska gas to market. This includes our past and present support of the Alaska Natural Gas Transportation System. Another reasonable alternative which has recently resurfaced, under the sponsorship of the newly created Yukon Pacific Corp., is the prospect of exporting North Slope gas to the Pacific rim, including Japan. Preliminary studies have shown that this option for exporting Alaska natural gas is worthy of serious consideration and further scrutiny.

We believe that the market should decide where North Slope gas is sold. As a matter of equity and economics, federal policy should allow the market to dictate the best destination for the gas. Because development of a delivery system for the resource will require such a tremendous investment, we need to allow the users who have the greatest need for North Slope gas the opportunity to develop and purchase it.

Development of North Slope natural gas through sales to the Pacific rim would provide several significant benefits to the nation as a whole:

First, large-scale sales of gas would obviously be a welcome contributor to the plus side of our balance-of-payments account. Since North Slope gas is as yet an undeveloped resource, delivery outside the United States would not require any additional energy imports.

Second, our relations with the nations of the Pacific rim would be enhanced by their knowledge that a valued ally was providing a stable, long-term source of supply for one of their most vital needs, energy.

Third, the development of North Slope gas reserves would spur additional exploration and development in that area, as companies with leasehold interests were provided with an opportunity to market existing and potential natural gas discoveries. We believe that such exploration and development is likely to yield substantial additional energy discoveries, with obvious national benefits.

Fourth, a marine delivery system would have the flexibility to provide natural gas to the lower 48 as well as to Pacific rim countries. The development of such a system in the United States would provide the opportunity, in the long run, for the Nation to utilize natural gas reserves from Alaska.

Finally, the development of North Slope natural gas will provide a significant boost to the national economy, with thousands of jobs created by construction of the delivery system and by the resulting increased exploration and development activities in northern Alaska. For example, the development of the Prudhoe Bay oil field created thousands of jobs in the lower 48 in addition to those created in Alaska.

In light of the national and State benefits set out above, Governor Sheffield discussed the development of Alaska natural gas, along with oil and coal, during our recent visit to Korea and Japan. We found a great deal of interest on the part of both private and public officials in our natural gas reserves. An effort to study the possible contribution of Alaska's North Slope gas to meeting Japan's energy needs is contemplated by the joint statement issued by President Reagan and Prime Minister Nakasone as a result of their recent meetings. That statement was quoted earlier by Mr. Wendt with the United States Department of State, and I won't repeat that. We do strongly support a joint effort by the United States and Japan in that direction.

Japan previously played a pioneering role in the development of Alaska's energy resources with the construction of the Kenai LNG delivery system in the mid-sixties. Because they currently are willing to pay more for natural gas than U.S. consumers, Japan may be better able to pay the costs of delivering North Slope gas to market than are U.S. consumers alone.

In closing, we will continue to support the existing efforts to bring Alaska gas to lower 48 markets. At the same time, we believe that a sound national energy policy requires a serious discussion of the option of export to the Pacific rim. We applaud the commitment made by President Reagan and Prime Minister Nakasone to conduct such an assessment, and look forward to cooperating in the proposed private feasibility studies.

Thank you, Mr. Chairman.

Senator MURKOWSKI. Thank you very much.

I believe you recently accompanied Governor Sheffield to Japan and had an opportunity to assess for yourself the attitudes prevailing with regard to the long-term energy commitments by Japan and I believe Mr. Mares commented briefly in his testimony with reference to the fact that these windows currently seem to be pretty well committed from other sources.

For the record, if you might give your particular assessment of how you feel that Alaska gas might find its way to the Pacific rim market recognizing the fact that Alaska gas probably isn't going to be cheap gas, and I'm generalizing when I use that terminology as opposed to current sources of supply that may come from Indonesia, that a layman at least would assume to be less costly gas.

Mr. LYON. I think if you look at two issues having to do with that market, Mr. Chairman. For one thing, it's very clear that there's a great deal of interest on the part of both the Koreans and the Japanese in Alaska as an energy resource. And as you have noted and I also commented, the Japanese market at least has shown that it's willing to pay the current price. For instance the LNG that moves into Japan right now moves in at a basket price for 20 crude equivalent, basket price of about $4.93, which is a pretty stout price. So we feel that they should be given an opportunity. From a volume standpoint Japan currently imports, the 1980 figure is around 16.8 million metric tons a year of LNG, and their own forecast which is rising to, the last I heard, around 43 million metric tons. We're talking about a system as I understand it from Alaska which would generate about 12 million tons a year. And what the Japanese say is uncovered in 1990 is about 5 million tons that's not presently contracted for. Those contracts I suppose are subject to change, but that market is big enough to at least justify a part of the Alaska investment. So from a pure volume standpoint we feel the market is there, even without displacing some existing contracted material.

Senator MURKOWSKI. Obviously, if liquefied gas in quantities that you're talking about are going to seriously be considered, you're talking about some long-term contractual commitments, sometime out in the future in order for the financing to be obtained. Do you have any indication of whether or not the State of Alaska might be interested in participating? I think this is a legitimate question that came up during the discussions on ANGTS at one time, was the posture of the State of Alaska because after all one-eighth of that gas is State royalty gas and the concept of having an equity interest in a pipeline to move State gas has an application regardless of where it moves.

Mr. LYON. The way we see it right now, we think the principle difficulties in the way of this project are No. 1 economic and No. 2 Federal.

Senator MURKOWSKI. Not State?

Mr. LYON. No, not State. At least this administration. No, it isn't, seriously. We want to come forward and examine the ways in which the State might participate. The principle thing we're saying right now is we want the marketplace to look very carefully at Alaska as a source, but we think there is a great deal that can be done right now just in getting closer to the folks that are involved in examining that question. But we certainly think it's vital that it be kept as a private sector initiative so that in fact what happens is viable in the marketplace.

Senator MURKOWSKI. From your testimony I gather that the official State position is continuing support of the existing ANGTS project and an open mind to any other project that would come along that would market the States' gas. Do you have any reason to believe that there is enough gas for more than one project?

Mr. LYON. It looks that way to us. The one thing that you can be sure, my background is as a petroleum geologist. That's how I got to Alaska. I won't bore you with anecdotes, a lot of folks want to say serious things today, but it's virtually certain that there is a great deal more hydrocarbon resource available to us in the State of Alaska so I would hate to see us back off from some opportunity simply because we felt there was insufficient supply. We probably have right now, except there is a specific disincentive to look for natural gas, as I think you mentioned in your opening remarks. Right now we want to find some way of inducing additional exploration to see what more gas is available out there. I believe the official figure is either 26 or 29 trillion feet in Prudhoe Bay itself with perhaps as much as another 4 trillion reasonably shown now. But the probably gas reserves in addition to that are certainly at any number I've ever seen well over 50 trillion feet. Without trying to pin that down, of course, that's a resource, that's not a pinned down proven reserve.

Senator MURKOWSKI. And you've come to the conclusion that the dilemma that's facing the State's ability to market its gas from the State on each issue, whether it be the ANGTS or another proposal, is that you're looking at high priced gas, competing with lower priced gas. It would appear that Canadian gas is substantially less, at least less than gas that would come from the State of Alaska if, in fact, the line were built. The Alaska gas would exceed the price of Canadian gas. The same application is true, it appears the consideration of liquefying the gas and marketing in the Pacific rim, you're competitively faced with cheaper gas. So why does it appear it's feasible if you draw a parallel conclusion that the ANGTS has not progressed beyond where it is because of cheaper Canadian gas, and you have the same set of circumstances about ready to apply in the Pacific rim?

Mr. LYON. Well, I think you mentioned that I would look at this from my perspective of commissioner of commerce and economic development. The perspective that the Sheffield administration has tried to get in to the administration, and particularly into my area of effort, is the marketplace. We try to look at what will the marketplace let you do?

Alaskans tend to think of themselves as living in this vast treasure house of natural resources, and that there's a whole flow of people out there knocking on the door ready to buy it, but ultimately, of course, somebody has to pay the price to make the transaction to take place in order to get the resources developed.

Our point isn't so much that we've been marketplace barred so far, is that there's another marketplace where they're currently paying more money, let's let them take a good, solid, positive look and let them know we want them to look at it.

California eventually will be in the same boat. One thing that I think there has not been too much of in the oil industry is an institutionalized memory. I tend to think, I guess we all have this problem, we tend to think today's situation will continue on. Well, it won't. God's not creating any more oil and gas. There's only so much out there. And what we want to do is find out now, because it will take 40 or 50 years just to carry forward with this one idea, and we think we ought to let the marketplace determine where is the best place to do that. And if that's both projects, then fine.

Senator MURKOWSKI. What if it's neither project?

Mr. LYON. Then we have to go back to square one.

Senator MURKOWSKI. You go back and wait under the premise that they don't make gas and oil any more.

Mr. LYON. It's like buggy whips. What we'll do I suppose is go back and find out is there another market that can be induced. What would have to be done? What's the next step?

Senator MURKOWSKI. Do you feel it's appropriate and practical for the administration in Washington to perhaps recognize that Japan is America's largest customer for Japanese goods and as a consequence as the largest customer it should be able to dictate certain terms which business as usual will incur in the sense of saying: All right, we'll continue to buy but you've got to buy some energy from us, and it might cost you a little more but it's the price you pay for protection of not being run away. As you know, there's a climate in Congress that's very actively involved with this particular issue and it stems from other States, other than those that make automobiles, that protection or feeling is a very real one.

I don't expect you to answer as a Federal official, but your perspective as a State official.

Mr. LYON. I'll admit that you get a very special view living in Alaska because No. 1 you feel close to Russia. It's a natural part of it. We're JAL's largest overseas operating base is in Anchorage.

You've got 1.5 million people a year in transit in Anchorage just to stand by the airport, so we feel close to them as a buyer. But I think what we want to look at, this represents a fairly straight forward way of dealing with debt balance of payments problems. We have something Japan wants, they have the money to pay for it and they're willing to do it. There is a difficulty with perception that says the energy goes to Japan and in return is imported Japanese manufactured goods. But it's a two way street, and in Alaska of course, we have exactly the opposite problem. We sell to Japan well over 10 times as much every year as we buy from them.

Senator MURKOWSKI. I have no further questions. I much appreciate your testimony.

Mr. LYON. Thank you very much, Mr. Chairman. I'm greatful for the opportunity to do this. The Sheffield administration does believe in the private sector and does believe in the marketplace. We think that ought to determine the most logical development.

Senator MURKOWSKI. I might ask you one more question of a leading nature. I'm wondering while this is somewhat removed from the issue at hand, do you feel the energy issue can stand on their own? And I'm talking about coal, gas, and oil, or if in reality they're linked? Do you feel there is a linkage to the communique that was signed a few days ago and negotiated in the realities of the concern that we have had here in Washington which Governor Sheffield has followed very closely with regard to some type of an amendment to the Export Administration Act that it might allow the export of a relatively small amount of oil, 50,000 to 200,000 barrels a day, in the U.S.-flag vessels with the restriction that the President can withdraw that at any time. And I'm wondering do you feel that gas is going to be more difficult or easier or will stand on its own whether or not there's any action taken on oil?

Mr. LYON. I think there's a linkage that's as much economic logic as anything else. The attractive part of crude oil is that the system is in place to do it today. If the decision were made this afternoon we could be shipping crude oil very shortly. If you make the decision, yes, we'll go forward with natural gas, you're talking about a rather long-term prospect. Coal is somewhere in between because you have, in Japan at least you have several years of conversion to handle the kind of coal that's likely to be available soon. So they are independent, they will stand alone. But I think it's a human tendency once we get this trade established we tend to add something else to it.

One of the reasons Japan is looking right now is because of the existing LNG deal which goes back 15 years.

Senator MURKOWSKI. You're aware that it appears that the Senate will not take up the Export Administration Act. It will have technically expired and we probably won't be taking it up again until we come back in late January. As a consequence I understand that the President has before him a communique from our Governor, and that communique specifically reflects the willingness of the State of Alaska to make available the specific amount of oil after taking care of in-kind needs for our State refiners, and is in effect a formal request to export royalty oil. Do you have any knowledge whether the President of the United States has acted upon that request?

Mr. **LYON.** I don't believe that he's responded to the Governor's inquiry. We may have to send a followup letter and make sure it doesn't get lost somewhere. Because the interest is absolutely there on the Japanese side and it seems very clear to us that this is such a logical next step that we ought to take.

Senator **MURKOWSKI.** I would assume it's the official position of the State of Alaska that they are offering a modest amount of oil to export and are requesting in effect a waiver. I don't know, and I don't suppose you do either, whether the President in effect has authority to allow that oil to be exported under his emergency authority now that the Export Administration Act has expired.

Mr. **LYON.** We're hoping he's at least thinking about whether he can do it because he certainly spoke in strong terms with the Prime Minister and the Prime Minister indicated to us that that would be an item of discussion.

Senator **MURKOWSKI.** I appreciate your voluntary remarks on the subject. Thank you, Mr. Lyon.

Our next witness, it gives me a great deal of pleasure to present to you Mr. Vernon Jones, president and chief executive officer, Northwest Energy Co., accompanied by Mr. Darrell MacKay, and Mr. Robert Pierce, chairman, Foothills Pipeline Co., Ltd., accompanied by Mr. Bruce Simpson and Mr. Murray Peterson.

This represents Panel No. 3, and I think it's fair to say, gentlemen, this represents the ANGTS consortium, at least the spokesmen for it. I welcome you and your associates to the panel and would ask that you proceed. While we've had a great deal of association with Mr. Pierce of Foothills, I had the pleasure, Mr. Jones, of meeting with you yesterday. I welcome you to the panel. And I understand it's been a few years since you've been up to look at your project in Alaska. Now that you've associated yourself with Northwest Energy Co., and speaking on behalf of many Alaskans, we invite you again to journey up there and take a look at that investment that's been made on your project already.

With that, I would request that you proceed at your pleasure and introduce your associates.

STATEMENT OF VERNON T. JONES, PRESIDENT AND CHIEF EXECUTIVE OFFICER, NORTHWEST ENERGY CO., SALT LAKE CITY, UTAH, ACCOMPANIED BY DARRELL MacKAY, NORTHWEST ENERGY; HARRY LePAPE, PACIFIC INTERSTATE; CLARENCE CONOLEY, PANHANDLE EASTERN; JACK ANGEL, SR., UNITED GAS; GEORGE SEITTS, INTERNORTH; G. W. WOODS, TRANSCANADA; F. BUTTON, TRANSCANADA; WAYNE HODGE, TEXAS EASTERN; MAX LEVY, COLUMBIA GAS, AND RALPH P. DEWEY, PACIFIC GAS & ELECTRIC

Mr. **JONES.** Thank you, Mr. Chairman.

I have with me, on my right, Mr. Darrell MacKay, of Northwest Energy. Since I'm the new guy on the block, I thought I might need his assistance in answering some of the questions. We also have with us today a number of the representatives of the partnership who are here with me and I'd like to introduce them. Mr. Harry LePape of Pacific Interstate; Mr. Clarence Conoley, of Panhandle Eastern; Mr.——

Senator Murkowski. I wonder, Mr. Jones, as you introduce those gentlemen, would they stand up and be identified? It would help me a bit.

Your first gentleman?

Mr. Jones. Mr. Harry LePape, of Pacific Interstate; Mr. Clarence Conoley, of Panhandle Eastern; Mr. Jack Angel, of United Gas; Mr. George Seitts, of Internorth; Mr. Woods, G. W. Woods, of Transcanada; and Mr. Fred Button, of Transcanada; Mr. Wayne Hodge, of Texas Eastern; Mr. Max Levy, of Columbia Gas; and Mr. Ralph Dewey, of Pacific Gas & Electric.

Senator Murkowski. We welcome you gentlemen to the committee hearing, and ask you to proceed, Mr. Jones.

Mr. Jones. Thank you.

Together with Northwest Energy Co., Exxon, Arco, and Sohio, this group of sponsors has demonstrated its commitment to the ANGTS project by an investment of nearly $700 million in the Alaskan segment alone. If you add to this the $225 million invested by the Canadian companies in planning for the Canadian segment and the $2.2 billion cost of the 1,500 miles of prebuilt facilities that we have already completed on both sides of the border, the total investment in all elements of the system to date is about $3.1 billion, all of it with private funds, and without Government contribution.

We as a group made this enormous investment for a single reason. We are convinced and remain convinced, that the proved reserves of Alaskan gas will be urgently required in the lower 48 States to help alleviate predictable shortages in the years ahead. This view is not limited to just the project sponsors. The ANGTS project was established and implemented pursuant to Federal law involving, I understand, six separate actions by Congress and conditional certificates of public convenience and necessity from the Federal Energy Regulatory Commission. Acting on these governmental commitments, the sponsors constructed the prebuilt facilities which were predicated upon, and whose ultimate viability depends upon, the long-term flow of Alaskan gas. And our investment in planning and engineering the remaining elements of the system has reduced the time required for their construction to a practicable minimum.

When the Alaskan gas flows, the prebuilt facilities will have been substantially depreciated with a result of reduced cost to consumers.

A major gas transportation system from the North Slope of Alaska can be financed and constructed only on the basis of proved reserves which Federal law requires must be formally reported to the Government each year. Because of the high cost of building and operating a pipeline system in Arctic and sub-Arctic conditions, the magnitude of those reserves must be substantial in order to permit construction of economical high capacity, long life system which is required for marketing the gas. All of the Prudhoe Bay area's reserves of natural gas, now committed to the ANGTS project, are necessary to permit the transportation costs which are essentially fixed, to be spread over a high volume of gas for a long period of time.

With respect to additional crude reserves that may be found in that area in the future, there has always been an expectation that they would be transported to market through the ANGTS. Indeed, the possibility of an increase in the volume of gas to be transported compared to the initial volume has been specifically taken into account in the framework of Federal law underlying the project, in our economic considerations, and in the planning of all segments of the pipeline system. The movement of additional gas, when and if it becomes available, could significantly lower the unit cost to the U.S. consumer.

An argument has been made by some that the U.S. should permit the export to foreign nations of Prudhoe Bay natural gas reserves in the form of LNG. It has been argued that in the event of a real need by the United States, the gas could be diverted to meet urgent requirements in the lower 48 States.

Natural gas is different from oil in that transportation systems for gas involve elements such as pipelines, compressor stations, and LNG terminals, which are designed, financed and constructed in fixed locations to meet specific continuing requirements with little flexibility for change. Consequently gas is sold only on the basis of binding long-term contracts which commit the reserves. If the presently identified North Slope natural gas reserves were committed to export, the facilities to bring gas to the lower 48 would not be constructed, and a major assured source of energy for the United States lost.

Any idea, moreover, of building both the facilities to export any significant portion of the estimated 28 trillion cubic feet of North Slope reserves and a pipeline to the lower 48 is unrealistic. In addition to adding major additional design, regulatory and finance complexities to an already complex project, it would saddle the U.S. consumers with a substantially higher transportation cost for gas received, and this would effectively preclude the marketing of gas and financing of the pipeline. In addition, it is totally unrealistic to expect equity sponsors or lenders to make speculative commitments to a major transportation system based on undiscovered or unproven reserves.

In short, it should be clearly recognized that there is sufficient marketable natural gas on the North Slope of Alaska, that is, proved reserves, for only a single project of a scale that would warrant construction of a large-diameter pipeline transportation system.

We continue to believe that ANGTS is the superior method for marketing the gas in terms of cost, completion date, environmental protection, financability, and protection of U.S. consumer interests. Any alternative transportation system that might be proposed would not only have to duplicate the present sponsors' financial commitment and preparation, it would also have to resolve major new environmental challenges and contend with a formidable existing legal and regulatory framework. It clearly would have to establish a new statutory basis because of the specific pipeline routing and commitment of gas to the ANGTS endorsed by the Congress.

There is no reasonable likelihood that North Slope gas can be delivered to market earlier by means other than the ANGTS project.

For this reason, we are convinced that the ANGTS project remains in the best interest of not only the lower 48 but of Alaska as well.

We, the ANGTS sponsors, remain committed to the project. We will continue preparations and will move the project forward as soon as economic conditions permit. For most of the pipeline transmission companies, we should remember that their primary, if not their sole, motivation in participating in this project stems from their need to obtain a long term, assured supply of gas for their own pipeline systems. As discussed in my written statement, we have demonstrated our ability, through a major innovative design optimization, to make substantial capital cost reductions. And other promising design and construction cost optimizations are now under serious study.

We have demonstrated that the delivered costs of the gas in the early years can be significantly reduced through a cost levelization method, as a result of which the gas can be delivered at market clearing prices. Mr. Chairman, let me emphasize that the gas can be delivered in 1990 at a price of about $5 per million Btu's, in January 1982 dollars. This compares with residual fuel oil prices today in the range of $4 to $4.50 per million Btu's, which can be expected to escalate in real terms over time. We can do this by deferring the recovery of certain costs to later years in order to levelize the tariff. This is in contrast to tariffs which traditionally heavily concentrate the recovery of costs into the early years, in fact requiring about twice the levelized amount in the first year.

The missing link in all of this is the fact that natural gas companies are not at this time in the market buying reserves to insure future deliverability to their customers. This clearly is a temporary condition which will end when the perception of a so-called glut of oil and gas disappears and forecasts of future shortages in the lower 48 States become more widely accepted. Because of relatively low reserves-to-production ratios in the lower 48 and the rapidity with which conditions can change, there could well be a stampede back to the market for deliverable reserves as the temporary surplus of marketable gas is exhausted and supplies come into closer balance with demand.

With regard to financing the project, we believe this will be possible when a strong demand for the gas becomes evident and doubts as to its marketability have been erased. At that time, other key elements of the financing can be reconsidered, such as debt/equity ratio, the respective shares of participation among present sponsors, the amount required to be financed in light of cost reductions achieved, declines in the rates of interest, and a decline in inflation, and the possibility of additional participants from the private and public sectors will also come into play This must be accompanied by a perception in the financial community that the United States and Canadian Governments wholeheartedly support the project and are doing all they can to clear away unnecessary obstacles in order to permit expeditious completion.

The North Slope gas was committed to the ANGTS project by the President and the Congress, and the commitment extended to formal agreements with the Government of Canada which have been formally reconfirmed to Canada by two successive Presidents. It quite fitting that I am sitting at this table with Robert Pierce, who represents the sponsors of the Canadian segment. It serves to emphasize that this is an international project that remains of great importance to both countries. The $3.1 billion already invested by Canadian and U.S. firms to complete and place into operation the prebuilt parts of the system and to do the planning for the remainder of that system is ample testimony to our reliance on these commitments by two Presidents and the Congress and our dedication to the project.

Speaking on behalf of the project sponsors, I want to assure the committee that we will continue to work toward the day when the ANGTS project can be put into service and gas will flow for the benefit of all Americans. Thank you for the opportunity to be here today.

[The prepared statement of Mr. Jones follows:]

PREPARED STATEMENT
OF
VERNON T. JONES
PRESIDENT AND CHIEF EXECUTIVE OFFICER
NORTHWEST ENERGY COMPANY

November 16, 1983

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE:

Good afternoon. I am Vernon T. Jones, President and Chief Executive Officer of Northwest Energy Company ("Northwest") and Chairman of the Board of Partners of Alaskan Northwest Natural Gas Transportation Company, the consortium of natural gas companies selected to design, construct, and operate the Alaskan segment of the Alaska Natural Gas Transportation System ("ANGTS"). I am also an Executive Vice President and Director of The Williams Companies ("Williams"), the parent firm of Northwest.

I appreciate your affording me the opportunity to testify on the marketing of Alaskan gas. Inasmuch as Williams recently acquired control of Northwest, I believe it is appropriate to set forth briefly our intentions regarding Northwest's future role in the ANGTS project. Prior to and during the acquisition, Williams gave very careful consideration to all aspects of the project, including the outlook for bringing Prudhoe Bay gas to market within a foreseeable period of time. We met with senior Canadian government authorities, with Northwest's existing management, with all of the other companies sponsoring the ANGTS project--

including the companies sponsoring the Canadian Segment, and we considered the views of other parties interested in marketing Alaskan gas. For a variety of reasons, Williams determined that Northwest's vigorous and positive stewardship of the ANGTS project will continue. Subsequently, I assumed the position of Chairman of the Board of Partners of the transmission company partnership sponsoring the Alaskan Segment. I also became Chairman of the Design and Engineering Board, which is comprised of the same nine gas transmission company sponsors, together with the three principal North Slope oil and gas producers: Exxon, Arco, and Sohio. We determined that Northwest Alaskan Pipeline Company, a wholly-owned subsidiary of Northwest, would continue to be agent and operator for the sponsors, manage the on-going design and other planning work on a day-to-day basis, and move the project forward in every way practicable.

We believe Williams brings new strength and leadership to the project. Senior management of Williams has been involved in the successful completion of a number of major projects, including construction of the two northern sections of the Alaska oil pipeline system, a 3,000 mile expansion of the Williams Pipe Line Company's petroleum products pipeline system in the lower-48 states, and the initial construction and subsequent expansion of the Williams Natural Gas Company's 300 mile intrastate pipeline system in Louisiana. I personally had an extensive career in the pipeline industry, including the presidency of Explorer Pipe Line Company during its construction, before joining Williams Pipe Line Company as its president in

1975; and I look forward with real anticipation to construction of the Alaskan Segment just as soon as economic conditions permit.

I will conclude these introductory remarks by summarizing briefly our view of the outlook for bringing Alaskan gas to market through the ANGTS project. In subsequent parts of this statement, I will explain in greater detail why we are convinced that this project remains today, as it was in 1977, the best choice, in fact the only realistic choice for marketing North Slope Alaskan gas. I will explain why we believe it best serves U.S. national interests and the interests of the citizens of Alaska and gas consumers throughout the United States. At the same time, it provides for substantial economic benefits to Canada, a valuable U.S. trading partner.

In summary, we are convinced that, at the appropriate time, Alaskan gas can be delivered to the lower-48 states at market clearing prices. We believe that this will occur when the perceived fuels "glut" disappears and forecasts of future shortages in the lower-48 states become more widely accepted. We believe that such shortages will occur, and this is a view shared increasingly by responsible authorities. Realistically, there will be no substitute available to the lower-48 states for the proved reserves of Alaskan gas, the largest single block of such reserves under U.S. control. This gas, the equivalent of 600,000 barrels of oil per day with the ANGTS system at full capacity, is a major, irreplaceable asset to the U.S. from a national energy security viewpoint.

We note that a major gas transportation system from the North Slope of Alaska can be financed and constructed only on the basis of "proved reserves." Because of the high cost of building and operating a pipeline system in Arctic and sub-Arctic conditions, the magnitude of these reserves must be substantial in order to permit construction of an economical, high capacity, long-life system. All of the Prudhoe Bay area's reserves of natural gas, now committed to the ANGTS project, are essential for this purpose. Indeed, the prospect of additional proved reserves that may be found in that area in the future has always been part of the sponsors' planning, as a means of reducing transportation costs to consumers per unit of gas delivered.

It should be recognized that both the original and current motivation of most of the pipeline company sponsors of the ANGTS is based on the need to obtain an assured, long-term source of gas for their own transmission systems. We believe that the ANGTS is the superior method for transporting the gas in terms of cost, completion date, environmental protection, financeability, and protection of U.S. consumer interests.

Finally, we believe the Congress and the American public should recognize that it is private initiative, investment, and assumption of responsibility by the sponsoring companies that have made the project essentially ready for implementation and made it possible to realistically view the Prudhoe Bay gas as America's "strategic natural gas reserve."

I. ANGTS PROJECT DEVELOPMENT

A. Overview

The Alaska Natural Gas Transportation Act of 1976 and a subsequent Presidential decision that was endorsed by the Congress resulted in a specifically designated overland pipeline route to bring a minimum of 26 trillion cubic feet ("Tcf") of proven reserves of Prudhoe Bay natural gas to market in the lower-48 states through a 4,800 mile pipeline system. The pipeline route extends from the North Slope of Alaska through Canada, thereby establishing a major natural gas transportation corridor, generally along existing rights-of-way. The pipeline will reach both California and the Mid-West, where interconnections with existing systems will permit Alaskan gas to be delivered to any pipeline system that has contracted to purchase the gas. To date, about one third of the total pipeline mileage has been privately financed and placed into operation (the so-called "prebuilt" facilities), at a cost of approximately $2.2 billion, temporarily bringing in surplus Canadian gas but predicated upon the anticipated long-term flow of Alaskan gas. 1/

The project was established and implemented pursuant to Federal law, involving six separate actions of Congress and a key action by the Federal Energy Regulatory Commission ("FERC"), which provided commitments to both Canada and the sponsoring

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1/ All investment figures cited in this statement, unless otherwise specified, are in U.S. dollars and include financing charges.

firms. Two successive presidents have formally reconfirmed the commitments. These actions are as follows:

1. The Alaska Natural Gas Transportation Act of 1976 (Pub. Law 94-586). This Act made a finding, among others, that "the expeditious construction of a viable natural gas transportation system for delivery of Alaska natural gas to United States markets is in the national interest."

2. A treaty, "Agreement Between the Government of Canada and the Government of the United States of America Concerning Transit Pipelines," executed January 28, 1977, and ratified by the Senate on August 3, 1977.

3. Joint Resolution of Congress enacted on November 2, 1977, approving: (1) the Presidential Decision, which selected a specific overland pipeline route and project and (2) the environmental impact statement for the ANGTS. The approved Presidential decision and report to Congress incorporated the "Agreement Between the United States of America and Canada on Principles Applicable to a Northern Natural Gas Pipeline" ("Agreement on Principles") (Pub. Law 95-158).

4. Conditional Certificate of Public Convenience and Necessity, issued by the FERC, granted on December 16, 1977.

5. Reorganization Plan No. 1 of 1979, having been addressed in Congressional resolutions, became effective on July 1, 1979. This transferred statutory enforcement authority to the Office of the Federal Inspector ("OFI").

6. Concurrent Resolution of Congress, passed in July 1980, expressing the sense of Congress of the importance of the ANGTS (S. Con. Res. 104, 96th Congress, 2nd Session).

7. Letter from President Carter to the Prime Minister of Canada, of July 18, 1980, which reaffirmed the U.S. commitment to the ANGTS.

8. Telegram from President Reagan to the Prime Minister of Canada, of October 6, 1981, which included the statement: "I believe that this [ANGTS] project is important not only in terms of its contribution to the energy security of North America, it is also a symbol of U.S.-Canadian

ability to work together cooperatively in the energy area for the benefit of both countries and peoples."

9. Joint Resolution of Congress, passed in December 1981, approving the President's recommendation for a waiver of law (Pub. Law 97-93). Among other provisions, this added the multi-billion dollar North Slope gas conditioning plant ("AGCF") to the project and authorized equity participation by the gas producers.

Acting on these commitments, including the commitment of the "Prudhoe Bay area gas," sponsors in the U.S. and Canada have invested over $900 million in private funds, without government contribution, in addition to their investment in the prebuilt facilities. These investments, which are continuing, have brought the project to an advanced stage of readiness for implementation.

The ANGTS, from a total system viewpoint, is comprised of four major elements, as follows: (1) the Alaskan Segment, consisting of the AGCF at Prudhoe Bay and the Alaska Pipeline System, (2) the Canadian Segment, (3) the Eastern Leg, and (4) the Western Leg.

For the Alaskan Segment, the most difficult and costly part of the system, the sponsors of the ANGTS have invested to date nearly $700 million of privately supplied risk funds in engineering and other planning. Construction has been deferred until marketing uncertainties have been reduced to the point that financing arrangements can proceed. These uncertainties stem from an upheaval in the world oil market, the current natural gas supply-demand-pricing imbalance which largely results from contract rigidities overlaid upon the statutory price structure, and the low level of economic activity. The project can be completed within 5 to 6 years from the date that final authorization from the FERC is received, depending upon the time of the year of such approval in relation to seasonal construction constraints in Alaska. Since a reasonable lead time for completion of financing arrangements by the sponsors and for necessary government approval is required, the earliest that gas would flow is 1990.

The Alaskan Segment of the project has a strong group of 12 sponsors, including the principal owners of the Prudhoe Bay gas (Exxon, Arco, and Sohio), declared buyers of the gas, and other major pipeline company investors. Two major U.S. engineering firms provide technical support to the sponsors: Fluor Engineers and Constructors, Inc., a subsidiary of the Fluor Corporation, and the Ralph M. Parsons Company. Overall project manpower devoted to the Alaskan Segment reached a peak of 1,800 people in April 1981. The sponsor's cost estimate has received exhaustive scrutiny by both the FERC and the OFI, and a comprehensive set of regulatory decisions is largely complete. A right-of-way over Federal lands in Alaska has been granted, along with permits for construction camps and airfields; and dozens of other government approvals have been obtained. Contacts have been established with suppliers of equipment and services and, on a world-wide basis, with parties who will participate in financing the project. The design for the AGCF has been formally approved by the OFI. The pipeline route has been accepted by the environmental community. Cost optimization studies and financial planning are continuing. Important technical work on frost heave design is also continuing, with sponsor expenditures of $5 million projected for 1984.

The Canadian Segment to transport Alaskan gas, in which investment now exceeds $225 million, will be built by Foothills Pipe Lines Ltd. of Calgary, and its Canadian owner companies, NOVA (formerly Alberta Gas Trunkline Ltd.) and Westcoast Transmission Company Ltd. A total of 530 pipeline miles, constituting the "prebuilt" facilities in Canada, has already been completed and placed into operation at a cost of $750 million. A large Canadian firm, TransCanada PipeLines, is also among the sponsors of both the Alaskan Segment and the Eastern Leg.

The Western Leg, already partially completed as part of the "prebuilt" system, is sponsored by Pacific Gas Transmission Company, an affiliate of Pacific Gas & Electric Company. The Eastern Leg, with 823 miles completed as part of the "prebuilt" system and already the largest gas pipeline project ever constructed in the U.S. at a cost of over $1.3 billion, is sponsored by a group of five major pipeline companies, four U.S. and one Canadian, and is operated by Northern Plains Natural Gas Company, a subsidiary of InterNorth, Inc. Only the 310 mile extension from Ventura, Iowa to Dwight, Illinois, and necessary compressor stations remain to be completed in order to transport Alaskan gas.

The following discussion elaborates on the project's readiness to begin construction of the Alaskan Segment from a technical viewpoint. Financing considerations will be covered later, following a discussion of gas marketability.

B. Readiness to Begin Construction of the Alaskan Segment

The basic AGCF design has been completed--a major technical accomplishment. This includes both the process and the plant designs. The next step, upon full remobilization, is completion of detailed design elaboration, including the preparation of equipment procurement documents. The work completed to date includes formulation of an up-to-date cost estimate for the AGCF.

With respect to the pipeline, the potential "frost heave" problem, which was the project's major technical challenge, has been essentially overcome as a result of the sponsors' $100 million, five-year state-of-the-art development programs in Arctic engineering and construction. The principal technical concern in designing a chilled-gas pipeline to be buried in Arctic and sub-Arctic soils is the need to limit strain on the pipe due to frost heave as the line crosses from areas of frozen to unfrozen soils. The results of the sponsors' pioneering development work lend confidence to design concepts and will permit considerable cost savings in constructing the line. It is, however, necessary to do some additional confirmatory work in order to obtain final government approval of the frost heave design criteria. The work required is the principal basis for the sponsors' $5 million 1984 work plan, which involves the operation of field test facilities in Alaska, extensive laboratory testing, and validation of computer simulation models.

The development of Design Criteria for the pipeline has been an important technical objective. This is required by stipulations in the sponsors' Federal Right-of-Way Grant. The criteria are divided into 30 sections. Only two of these have not yet received OFI approval, and final action on them is expected in the near future. Design Criteria for compressor and metering stations and for telecommunications are complete and have been approved.

Regarding environmental matters, the sponsors completed major studies from 1976 to 1981 to collect detailed field information to support design and construction. Subject areas covered include: (1) fisheries, (2) endangered species and other birds, (3) mammals, (4) habitat evaluation, (5) cultural resources, (6) air and water quality, (7) liquid and solid waste management, (8) oil and hazardous substances, (9) noise control and visual resources, (10) forest resources, (11) environmental master guide, briefings and orientation, (12) site assessment and restoration.

In broad perspective, the pre-construction engineering and environmental planning required to build both the AGCF and the pipeline in Alaska are at an advanced stage. Upon completion of the 1984 engineering workplan, there will still be some additional pre-construction work needed after full project remobilization; however, all of the major work items precedent to the mile-by-mile design will have been completed. A number of cost optimization studies, moreover, have been completed and are under review by the sponsors. The significance of all this preliminary work is that a great number of major milestones, including key government approvals, have already been passed, and the project has been brought to a high-level threshold of readiness to proceed rapidly toward construction.

Attachment A is a list of specific engineering and technical data collection accomplishments on the Alaskan Segment.

II. NEED FOR ALASKAN GAS IN LOWER-48 STATES

The U.S. currently relies on natural gas for a major portion (about 26%) of its energy needs. In this part of my statement, I will review the prospects for satisfying those needs in the lower-48 states in the future by analyzing the following considerations: (1) natural gas production potential in the lower-48 states, (2) gas import potential from foreign nations, and (3) the demand for oil vs. gas as a function of world oil prices.

A. Natural Gas Production Potential in the Lower-48 States

A comprehensive review of the potential for natural gas production in the lower-48 states, with projections into the next century, is contained in a recent report by the Office of Technology Assessment ("OTA"). 2/ In this report, OTA reviews various alternative estimates of remaining conventional natural gas resources in the lower-48 states. These estimates, made by responsible sources such as M. King Hubbert, the RAND Corporation, the U.S. Geological Survey ("USGS"), and the Potential Gas Committee ("PGC") range from pessimistic (244 Tcf) to optimistic (916 Tcf) levels. OTA concludes that "the gas discovery trends of the past several decades, while not supporting the most pessimistic...estimates also do not support the relatively optimistic estimates of PGC and, possibly, USGS."

2/ Office of Technology Assessment, Congress of the United States, U.S. Natural Gas Availability, Conventional Gas Supply Through the Year 2000, September 1983.

OTA makes a strong point that the uncertainties in any assessment of gas resources are so substantial that "they prevent a reliable estimation of the remaining recoverable gas resource and the likely year 2000 production rate." Based on its own assumption of a 400-900 Tcf range of remaining economically recoverable resources, OTA concludes that lower-48 conventional production could range from 9 to 19 Tcf per year by the year 2000, a factor of 2 from the lowest to the highest estimate.

Regardless of what point within this range of projected production is correct, one fact is strikingly clear, that is, "conventional" natural gas production in the lower-48 states peaked several years ago, and all of the alternative estimates of the resource base--even the most optimistic--foreshadow a sharp, inevitable decline in production at some point. I have included with this statement a graph from the OTA report, based on an assumed 400 Tcf of remaining recoverable lower-48 resources, to illustrate how such a decline might occur, commencing in the mid-1980s (Attachment B). It should be noted that, although this is a "pessimistic" projection from OTA's viewpoint, it is optimistic compared to a number of other forecasts considered by OTA. For example, M. King Hubbert's estimate of ultimately recoverable resources in the lower-48 states is only 244 Tcf. Hubbert, it will be remembered, despite almost universal disbelief and criticism, persisted in his 1962 prediction of a peak and subsequent decline in U.S. oil production, which occurred in 1970, only a year later than his prediction.

The only matter at issue is when the rapid decline in lower-48 conventional production will commence. I have also attached a list compiled by OTA of 20 different public and private sector forecasts of future gas production (Attachment C). Four of these forecasts, incidentally, somewhat speculatively include gas from Devonian shale and/or tight sands. Nevertheless, it is noteworthy that there is virtual unanimity in projecting substantial declines in gas production by 1995. Another projection, by the U.S. Department of Energy ("DOE"), also shows significant declines in production, reserves, and reserve additions by 1990 (Attachment D).

There certainly is no lack of clear warning to the Congress and the American public of a potential domestic gas shortage in the years just ahead. For example, Richard Nehring, a RAND Corporation expert on world petroleum and gas supplies, said that the natural gas surplus that exists in the U.S. could disappear by late 1984. "If we are going to characterize the domestic natural gas situation as a glut, it is the most unique glut in the history of natural resource gluts." Nehring said "the [temporary excess supply] situation has been created by low demand caused through economic sluggishness and through conservation." 3/ Another expert, Geoffrey M. Hertel, the chief oil and gas analyst for Houston-based investment bankers Rotan Mosle, Inc., predicted an acute shortage of natural gas within

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3/ "Expert: Natural Gas Surplus Will Fade," The Register (Los Angeles), March 27, 1983, page A26.

two years. Rotan Mosle's detailed analytical report concludes that: "...the natural gas oversupply situation is not chronic.... Perhaps the most disturbing aspect...is the projection that natural gas markets could be severely supply constrained by 1985." 4/ A Wall Street Journal report included the following statement: "As for natural gas, most experts expect a shortage eventually; the current surplus is slowing exploration, and the big new finds of gas, like oil, tend to be in inaccessible places." 5/ More recently, a Merrill Lynch report concluded that "we are barreling toward a natural gas shortage in the mid-1980s...." 6/ All of these predictions are solidly founded on statistics showing an unprecedented and alarming falloff in leasing, drilling and well completions.

With regard to synthetic gas from coal or other materials, gas in tight sands, Devonian shales, coal seams, and geopressurized brine, it is quite possible that increases in gas prices and changes in technology may permit the entry of these "nonconventional" gas sources to market. We believe, however, that long before this occurs on any significant scale, Alaskan gas delivered by the ANGTS project will be strongly in demand and will be recognized as a genuine bargain to U.S. consumers.

4/ "The Natural Gas 'Bubble'," Rotan Mosle Industry Review Report, February 25, 1983.

5/ "Is the Oil Crisis Over? Experts Doubt It," Wall Street Journal, April 18, 1983, page 1.

6/ "Bursting the Bubble, "Natural Gas Monthly, June 1983, Merrill Lynch, Pierce, Fenner & Smith Inc. See also Barrons, October 10, 1983, page 13 et seq.

With the U.S. dependent upon natural gas for more than a quarter of its total energy consumption, and in the face of a sharp reduction in projected lower-48 conventional gas production in the relatively near future, the U.S. national interest in retaining the major gas resources at Prudhoe Bay for domestic use seems obvious.

B. Gas Import Potential from Foreign Countries

1. Introduction

It is reasonable to examine the extent to which the lower-48 states might find gas imports from foreign nations more attractive in terms of price and availability than Alaskan gas. If the U.S. were again to be faced with gas curtailments, the U.S. no doubt would attempt to increase gas imports from foreign nations, subject to their economic and political decisions. The danger involved is best illustrated by Algeria's reneging in 1980 on firm contractual arrangements for liquefied natural gas ("LNG") exports to the Cove Point, Maryland, and Elba Island, Georgia, facilities. The LNG project has not been reestablished.

2. Mexican Gas

Increased U.S. energy dependence on even its close neighbor, Mexico, is not without great potential difficulty. Negotiations for U.S. imports of Mexican oil and gas were protracted and characterized by Mexican attempts to force the U.S. into major political concessions on the purchase of Mexican agricultural products and on immigration. The price of imported Mexican gas, moreover, is tied to world oil prices and would escalate sharply in the event of a new energy crisis.

With regard to the availability of Mexican gas, OTA notes that "there is a considerable range of estimates for the future quantity...available for export to the United States." OTA also points out that "the Mexican Government's current export philosophy seems to preclude significant increases in exports to the United States."

Another key constraint on Mexican exports is identified by OTA as follows:

> Mexico has been successful in encouraging conversions to natural gas, and, as a result, domestic gas demand has been growing at a rate of 13 percent per year. Because Mexico's financial condition has precluded investment in distribution equipment, the primary constraint to increased domestic consumption is a lack of transmission and distribution capability. As the distribution system develops and the process of converting end users to gas progresses, domestic consumption will increase, which could further constrain the exportable surplus. 7/

In short, Mexican gas does not appear to be a realistic, politically reliable alternative to Alaskan gas for domestic requirements in the 1990s and beyond.

3. Canadian Gas

OTA, while pointing out the current Canadian surplus export capability, highlights Canada's 1980 National Energy Plan ("NEP"), the overall objective of which is Canadian energy self-sufficiency by 1990. According to OTA, although the NEP calls for increased consumption of gas in Canada in place of foreign

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7/ OTA, op cit., page 100.

oil imports, an unintended effect might be to "lessen the quantity of gas produced in the remainder of the century, thereby limiting the availability of surplus for export to the United States." 8/

The anticipated decline in deliverability of Canadian gas for export was officially expressed in specific terms by the Canadian National Energy Board ("NEB"). 9/ The NEB projects increasing Canadian domestic requirements for gas through the year 2000; however, gas deliverability, drawing upon both "established reserves" and future "estimated reserves additions," reaches a peak in 1987 and declines thereafter. The projected "surplus," i.e., the gas in excess of Canadian domestic requirements and available for export, is exhausted by 1998. All of this "surplus" is now covered by the NEB's export approvals announced in January 1983. Canadian gas exports are projected by NEB to peak in 1990 and decline rapidly thereafter. Attachment E to this statement is a graph which clearly shows the short-term nature of Canadian exports. Because export volumes currently are well below the amounts licensed, it is possible that the peak will actually occur somewhat later than 1990; however, this does not alter the fundamental situation.

8/ OTA, *op cit.*, page 101.

9/ Minister of Supply and Services, Canada, *National Energy Board, Reasons for Decisions...of the Gas Export Omnibus Hearing, 1982*, January 1983.

It is only fair to note that the NEB did not include in its consideration any potential deliverability from "frontier areas," which it defines as:

> [t]hose areas of Canada which have a potential for but no history of production. These include the MacKenzie Delta-Beaufort Sea area, the Arctic Islands and the offshore areas.

I would observe, however, that the marketability and deliverability of gas from these remote areas is likely to be even more difficult than for Alaskan gas, which will benefit from the well established infrastructure associated with the existing Alaska oil pipeline system and the Alaska highway. In fact, the ANGTS has been viewed by Canada as an important link for deliverability of much of its frontier area resources, by permitting construction of the so-called "Dempster Lateral" from the MacKenzie Delta area to connect with the ANGTS. This sharing of facilities, contemplated in the 1977 Canada-U.S. Agreement on Principles, would reduce delivery costs to both U.S. and Canadian consumers.

In summary, while last year's and the current year's market disorders in the U.S. have resulted in exports below forecasted levels, the current surplus of Canadian gas cannot persist indefinitely, and the projected decline in Canadian deliverability and exports of gas in the 1990s is likely to accentuate the lower-48 states' demand for Alaskan gas.

4. LNG Imports

Large scale projects to import LNG into the U.S. have not had a good record of success. Marketability of the gas is substantially dependent upon unpredictable pricing and delivery decisions by foreign sellers and governments. It appears doubtful at this time that U.S. policy will permit LNG imports from foreign nations to represent any significant part of U.S. gas supply. (With respect to LNG from Prudhoe Bay, incidentally, the alternative was exhaustively analyzed and rejected in 1977 as being more costly to U.S. consumers and more disruptive to the environment than the ANGTS project; no new facts have been adduced to change this conclusion.)

C. The Demand for Oil vs. Gas as a Function of World Oil Prices

Future world oil prices are likely to have a major, if not decisive, role in determining the lower-48 states' demand for natural gas because a substantial part of the market for gas in the lower-48 states is capable of switching to alternative fuels, primarily to residual fuel oil.

Projections of future world oil prices are contained in DOE's recently issued National Energy Policy Plan. In the report, DOE makes the following statements:

> Although there are large inherent uncertainties about future world oil prices, the current projection is that world oil prices will tend to fall in real terms until the middle 1980s.
>
> Between 1985 and 1990, demand for OPEC oil is projected to increase as world economic activity expands. Sometime between 1986 and 1990, demand for OPEC oil is projected to reach 24 million to 26 million barrels per day. This level of demand should create significant upward price pressure in the world oil market. By 1990, the world oil price in 1982 dollars is likely to be between $26 and $40 per barrel.
>
> Beyond 1990, world oil prices are extremely uncertain and speculative, but are projected in real terms to

reach between $36 and $80 per barrel by the year 2000 and between $55 and $110 per barrel by 2010. 10/

The decreasing availability of OPEC oil to the industrialized countries from the late 1980s forward, as projected by DOE, is shown in Attachment F. The resultant increase in world oil prices, also as projected by DOE, is shown graphically in Attachment G. It should be noted in Attachment G that DOE anticipates increases in world oil prices, in real terms, for each of its scenarios, even the most conservative, during the period 1983-1990. After 1990, oil prices in real terms are projected to rise substantially, and this should contribute to the demand for natural gas. Based on facts I will cite, we believe this increased demand is likely to occur before 1990.

The industrial and electric generation market for gas is very sensitive to changes in the price of either gas or oil, as demonstrated by statistics gathered by the American Gas Association ("AGA"). U.S. industrial gas users (including electric utilities) which have the capability of switching to other fuels, primarily to No. 6 residual fuel oil, consume over 6 Tcf of gas annually. This major, potentially switchable sector of gas demand, the equivalent of about 3 million barrels of crude oil per day, constitutes a serious potential threat to U.S. energy security if the unavailability of competitively priced

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10/ U.S. Department of Energy, The National Energy Policy Plan, October 1983, pages 21-22.

natural gas results in an increase in imported oil. 11/ With about 35% of U.S. gas consumed in boiler fuel and other so-called "low value" uses, which would otherwise require residual fuel oil or coal, the price of residual fuel oil clearly has been establishing the market clearing price of natural gas.

The sensitivity of gas markets to the price of residual fuel oil is clear from recent experience. From 1978 through year-end 1983, the AGA estimates that a net switch from gas to oil will have occurred in the industrial and electric generation areas of about 300,000 barrels per day or about 0.6 Tcf annually, with much of this switching having occurred in the last several years with a price differential, favorable to residual fuel oil, of only 4% to 11%. 12/ Much of this demand is expected to be switched back to gas if its price again becomes favorable relative to residual fuel oil.

Such a switch could be imminent. The AGA, in April 1983, projected a 17% increase in wholesale residual fuel oil prices (average sulfur content) from the then current $24 per barrel price to $28 per barrel in 1984 based on a continuation of U.S.

11/ The amount of currently available fuel switching capacity is derived from a combination of published AGA statistics, discussion with AGA officials, and with James T. Jensen of Jensen Associates, Boston, Mass., a highly respected consulting firm in the area of oil and gas supply-demand.

12/ AGA, "Industrial Fuel Switching: 1982 Actual and 1983 Potential," Energy Analysis, No. 1983-10, July 29, 1983, page 2. More recent discussions with AGA officials regarding currently available data confirm the figures cited.

economic recovery, on the need to replenish depleted residual fuel oil inventories, and on continuing refinery upgrading. 13/ Since then, wholesale prices of residual fuel oil (average sulfur content) have increased to a current average of about $26-27. This price increase, together with a moderation in natural gas prices now being experienced, supports the view that a resurgence of demand for gas in the industrial and electric generation areas is likely in the years immediately ahead.

In addition to regaining the highly price-sensitive part of the market that has switched from gas to oil, there is a potential shift to gas of another 600-900 thousand barrels per day of immediately displaceable oil in the industrial and electric generation sectors. 14/ Thus the total estimated potential for immediate switching from oil to gas in the industrial and electric generation sectors alone amounts to 900 thousand to 1.2 million barrels of oil per day, or 1.8-2.4 Tcf annually. The ANGTS, incidentally, with an initial volume of 2.0 billion cubic feet per day ("Bcfd"), could supply about 30-40% of

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13/ AGA, "Outlook for Residual Oil Supply, Demand and Prices: 1983-1984," Energy Analysis, No. 1983-6, April 15, 1983, page 1.

14/ AGA, "Recent and Potential Substitution of Oil with Gas and Coal in Non-Transportation Uses," Energy Analysis, No. 1981-4, December 18, 1981, page 4. Discussion with AGA officials suggests that the 900 thousand barrels of oil per day cited in this reference as a potential for switching may be smaller today due to the recession and associated plant closures. Accordingly, a range of 600-900 is used for purposes of this statement.

this major potential surge of demand; and with the ANGTS at its expanded, full capacity, it could supply about 48-65%.

To place into better overall perspective the potential demand for gas that could very quickly develop, it should be noted that a precipitous 14.6% decline in industrial natural gas consumption occurred just in 1982, amounting to 1.2 Tcf. AGA estimates that about 46% of this decline resulted directly from the decline in industrial output; only 29% was attributable to switching to residual fuel oil and other fuels. 15/

The point is that a return of industrial output to more normal levels would likely create major additional demand for gas at the same time that any switching from oil to natural gas were occurring as a result of a favorable price differential with residual fuel oil.

Another factor, very difficult to quantify, could add additional upward pressure to world oil prices over the years ahead. Although oil consumption by the free world industrialized countries declined since 1972, the Communist countries and the less developed countries ("LDCs") increased their oil consumption by 9 million barrels per day during the same period. 16/ As is evident in Attachment F, DOE projects major increases in oil consumption by the OPEC countries and in net exports to the LDCs

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15/ AGA, "U.S. Natural Gas Demand from Mining, Manufacturing and Agricultural Industries," Gas Energy Review, Vol. 11, No. 4, April 1983, page 5.

16/ Petroleum Intelligence Weekly, Special Supplement, October 10, 1983, attributed to James T. Jensen, Jensen Associates.

from 1985 onward. In reality, we can only speculate about the effects on future oil demand of the rapid population growth that is continuing to occur in the LDCs and the resultant unprecedented rates of urbanization. It is sobering to note, for example, that populations in most Central American countries will double in 19 to 27 years; and by the year 2000, the United Nations projects over 12 million people will be added to Mexico City's current population of 15 million. Such events, which will also occur in Africa, Asia and the Middle East, have been described as "off the scale of human experience." Clearly this could have a profound impact--beyond current projections--on world-wide demand for energy. 17/

Should world oil prices resume their upward trend in real terms, as DOE projects, the demand for natural gas is likely to increase considerably, and this very likely would be occurring at a time when lower-48 conventional production and Canadian imports are declining. If gas is not available to meet this demand, the U.S. may have little alternative but to increase its oil imports. Clearly, this would not be in our national interest.

D. Summary

The U.S. is approaching, and will experience in a short span of years ahead, an event of major significance to its pattern of energy supply--the rapid decline of conventional natural gas

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17/ Population Crisis Committee, "World Population Growth and Global Security," Population, Washington, D.C., No. 13, September 1983, page 2.

production in the lower-48 states. The U.S. cannot safely assume that LNG imports or Mexican or Canadian gas will be available on a large-scale, long-term basis to meet U.S. needs in the 1990s and beyond. In fact, the currently available "surplus" of Canadian gas is expected to decline rapidly at the same time that U.S. lower-48 production is declining. World oil prices, in the same time period, are projected to increase in real terms, which will create additional demand for natural gas. With the large fraction of the industrial and electric generation sectors that currently uses gas, but has a dual fuel capability, if competitively priced gas is not available, the alternative is residual fuel oil, with an accompanying increase in oil imports.

Clearly, if priced competitively, there will be a strong demand for the assured, long-term supply of Alaskan gas. This gas could provide an important stabilizing effect on lower-48 gas markets during the expected times of turbulence and uncertainty that will characterize energy supply markets in the 1990s.

III. AVAILABILITY OF ALASKAN GAS

The magnitude of marketable natural gas in Alaska, i.e., of "proved reserves," is a key consideration in relation to the lower-48 states' potential reliance upon that gas. The gas can be marketed and a transportation system constructed only on the basis of firm, long-term contracts that are founded solidly on an adequate base of proven reserves. These reserves, reported by DOE's Energy Information Administration ("EIA"), may be compared to other natural gas resource categories in Alaska as follows:

Category	Tcf
1. Proved Reserves 18/	35
2. Unconfirmed/Undiscovered: 19/	
°Probable Resources	8
°Possible Resources	29
°Speculative Resources	97

18/ U.S. Department of Energy, Energy Information Administration, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1982 Annual Report, August 1983, p. 18. This report is based on proprietary data and deals only with "proved reserves." It currently is the only source of comprehensive, nationwide proved reserves estimates. Reporting of reserves to DOE/EIA is mandatory under Federal law.

19/ Potential Gas Agency, Colorado School of Mines, Golden, Colorado, Potential Supply of Natural Gas in the United States (as of December 31, 1982), Report of the Potential Gas Committee, June 1983, p. 5. The PGC is a volunteer organization comprised of personnel from all segments of the natural gas industry, including producers, pipelines, distributing companies, government and academia. The report provides the most current estimates of potential gas resources. Another source of information on potential resources is the USGS; however, the USGS does not make a breakdown into probable, possible, and speculative categories. Its most recent report, "Circular 860," was published in 1981, based on a 1980 reappraisal. The USGS's "mean value" total of 106.8 Tcf of "undiscovered recoverable resources" plus "inferred reserves" in the Alaska region may

(Continued on next page)

In the "proved reserves" category, it should be noted that 30.8 Tcf, over 88% of these reserves, is "associated-dissolved gas," most of it in the Prudhoe Bay reservoir. 20/ In the "unconfirmed/undiscovered" category, over 62% of these potential gas resources is estimated by the PGC to be in offshore areas. This includes 2, 13, and 69 Tcf of gas, respectively, in the "Probable," "Possible," and "Speculative" categories. Transportation of gas from offshore areas in the Arctic and sub-Arctic obviously would present significant new environmental and cost hurdles to be overcome.

A comparison to previous year reports by the authorities that prepared these resource estimates is of interest. The PGC report notes that "there has been a reduction of 11 Tcf in the estimate of Speculative resources [of Alaska]...due largely to better definition of the basins in the Bering Sea area." (Emphasis added.) The DOE/EIA report notes that there were essentially no discoveries of new reserves in Alaska in 1982,

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19/ (Continued from previous page) - be compared to the PGC's total for potential resources in the same geographic area of 134 Tcf. PGC members have access to proprietary industry data, but the USGS report is based on publicly available information. An excellent comparison of the PGC and USGS approaches may be found in the previously cited OTA report (page 38, *et seq*.).

20/ Of the "associated-dissolved gas," a precise breakdown by geographical area in the Alaskan region is not publicly available. The original estimate of 26 Tcf of proven reserves at Prudhoe Bay is known to have been revised upward in recent years. In addition, there is another, much smaller producing field on the North Slope--the Kuparuk field. A current reasonable estimate of North Slope proved reserves, including both the Prudhoe Bay and Kuparuk fields, is 28 Tcf. (See also footnote 21.)

and a 2.2 Tcf increase in proved reserves was attributable solely to a redetermination of hydrocarbons in place in associated-dissolved natural gas reserves. 21/

Alaskan gas is of major significance to the United States. Proved reserves at Prudhoe are equal to over 15% of total proved natural gas reserves in the lower-48 states. Reserves-to-production ratios at the end of 1982, which provide a relative indication of reserve life, were 9.5 for the lower-48 states alone and 11.5 for the total U.S. (including Alaska), a full 21% higher, which emphasize the importance of Alaskan reserves to U.S. gas supplies. 22/

Proved reserves, of course, are the only basis upon which gas sales contracts can be made and transportation projects initiated for such a major international undertaking. If the estimated 28 Tcf of North Slope proved reserves, which is committed to the ANGTS project, is subtracted from the total proved reserves in Alaska, only 7 Tcf remain, and most of this is in the Cook Inlet vicinity. The construction of a major pipeline system from the North Slope of Alaska is so expensive that the delivered gas can be marketed only if transportation costs, which are relatively fixed, can be spread over a high volume of gas

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21/ In its 1982 annual report, ARCO identifies 10.217 Tcf of "North Slope" reserves in contrast to 8.8 Tcf in its 1981 report. ARCO attributes the increase to the Prudhoe Bay and Kuparuk River fields, but does not provide a breakdown between the two fields. This increase accounts for much of the positive revision reported by DOE/EIA.

22/ DOE/EIA, op cit, page 8.

delivered for a long period of time. The proved North Slope reserves that have been committed to the ANGTS, with initial delivery of at least 2.0 Bcfd, have always been considered an essential, minimum prerequisite to construction of an overland gas transportation system from the North Slope.

With respect to additional proved reserves that may be located in that area in the future, there has always been an expectation that they would be transported to market through the ANGTS. Indeed, the possibility of a 60% increase in the volume of gas to be transported, compared to the initial volume, has been specifically taken into account in the framework of Federal law underlying the project, in our economic considerations, and in the planning of all segments of the pipeline system. The movement of additional gas could significantly lower the transportation costs per unit of gas received by consumers.

An argument has been made by some that the U.S. should permit the export to foreign nations of Prudhoe Bay natural gas reserves in the form of LNG. It has been argued that, in the event of real need by the U.S., the gas could be diverted to meet urgent needs in the lower-48 states. Natural gas, however, is different from oil in that transportation systems for gas (e.g., pipelines, compressor stations, LNG terminals) are sized, financed and constructed in fixed locations to meet specific continuing requirements, with little flexibility for change. Consequently, gas generally is sold only on the basis of binding long-term contracts which commit the reserves to the purchaser. If North Slope natural gas reserves were committed to export, facilities to bring the gas to the lower-48 states would not be constructed, and a major assured source of energy would be forever lost to the U.S.

Any idea, moreover, of building both the facilities to export any significant portion of the 28 Tcf of proven North Slope reserves and a pipeline to the lower-48 States is unrealistic; in addition to adding major additional design, regulatory, and financing complexities to an already complex international project, it would saddle U.S. consumers with substantially higher transportation costs per unit of gas received which would effectively preclude marketing the gas and financing the pipeline. In addition, it is totally unrealistic to expect potential equity sponsors or lenders to make a speculative commitment to a major transportation system based on undiscovered resources.

In short, it should be clearly recognized that there is sufficient marketable natural gas on the North Slope of Alaska, i.e., proved reserves, for only a single project of a scale that would warrant construction of a large-diameter pipeline transportation system.

IV. MARKETABILITY OF THE GAS

A. Introduction

The marketability of Alaskan gas, which is the key to financing the construction of a transportation system, will be determined in part by the various factors discussed in preceding sections of this statement, namely: (1) natural gas production potential in the lower-48 states, (2) gas import potential from foreign nations, (3) world oil prices, with their influence on the demand for oil vs. gas, and (4) the availability of sufficient proved reserves of gas in Alaska to permit construction of a long-life, high-capacity pipeline system.

More directly, however, marketability will be determined by two additional factors, as follows: (1) capital costs and the resultant "cost of service" of the transportation system, and (2) the wellhead price of the gas. A promising technique to help achieve marketability is "cost levelization." The conclusion reached in this part of my statement is that the gas indeed will be marketable by 1990 and beyond provided that steps are taken to modify, i.e., "levelize," the traditional cost recovery pattern by deferring recovery of certain costs to later years. A levelized 1990 first year delivered cost of gas that can be achieved, as compared to the cost using a traditional approach, would be as follows:

Gas Delivered to Burner-Tip
(1982 $/MMBtu)

Traditional Cost	Levelized Cost
$9.85	$5.00

The levelized cost of $5.00, for gas delivered in 1990, may be compared to a current estimated market clearing price (at the burner tip) in the range of $4.00 to $4.50 per MMBtu, which can be expected to escalate in real terms by 1990. I will now elaborate upon the basis for this result.

B. Capital Costs and Cost of Service of the Transportation System

1. Capital Costs

As a general rule of thumb, we estimate that the transportation costs of Alaskan gas are likely to constitute about 75% of the total cost of the gas delivered to market. Of these transportation costs, the fixed cost portion represents about 95% of the total. Capital costs of the transportation system, therefore, will have a direct relationship to gas marketability. For this reason, the ANGTS sponsors have placed major emphasis on reducing capital costs by making various cost optimization changes in our design and construction plans for the project.

In June 1980, the sponsors of the Alaskan Segment filed with the FERC a comprehensive cost estimate for the gas pipeline in Alaska. In December 1981, a cost estimate for the AGCF was filed with the FERC. Each of these filings subsequently was updated to reflect more current information. The FERC, in February 1983, approved a reduced cost for the gas pipeline, compared to the sponsors' filing, for purposes of establishing a benchmark for an Incentive Rate of Return ("IROR").

Subsequently, a fundamental change in the process used in the AGCF resulted in a major cost estimate reduction which was publicly announced in August 1983 (see Attachment H) and which will be formally filed with the FERC in December 1983. For the pipeline, a number of studies have been completed which also offer the prospect of substantial cost reductions. I should note that this has been a major effort over the past 18 months, involving a multi-million dollar commitment of funds by the sponsors. The Canadian sponsors are similarly considering certain cost optimization measures for the Canadian segment. Although these studies are continuing, the substantial reductions already anticipated in base-year capital costs clearly will have a most favorable effect on marketability inasmuch as a $1 billion reduction in capital costs translates into a reduction in the first year transportation cost of service of about $0.30 per MMBtu, with both figures in January 1982 dollars.

Since the sponsors' optimization studies are not complete, a firm cost estimate for the ANGTS is not yet available; however, based on the work done to date, we can make a reasonable assumption that the capital cost of all segments of the ANGTS, in January 1982 dollars, is as follows: 23/

Capital Costs
(Billions, 1982 $)

Alaskan Segment (Including the AGCF)	$14.2
Canadian Segment	7.7
Lower-48 States	3.4
	$25.3
Less Prebuilt Facilities	(2.2)
Total Completion Facilities	$23.1

23/ These costs include allowances for contingencies; however, they do not include any financing costs, i.e., any "allowance for funds used during construction."

2. Transportation Cost of Service

The ANGTS transportation cost of service is based on the capital costs of all segments of the pipeline system. It covers the aggregate of depreciation, return on equity, income taxes, property taxes, interest expense, fuel, and operation and maintenance expense for all segments of the system. As the original capital cost of facilities placed in service is depreciated over time, the initial rate base becomes smaller, with the cost of service declining significantly. Attachment I is a graph showing this decline, which is particularly steep in the early years of service. Thus, a traditional cost of service for the ANGTS would commence at a relatively high level and decline rapidly in "real" terms over time. This pattern makes it possible to effectuate cost levelizing concepts to make the Alaskan gas marketable in the earlier years of the project, as discussed later.

It should be noted that by the time Alaskan gas is delivered, capital costs for the "prebuilt" portions of the system will have been significantly depreciated, thus resulting in a lower transportation cost of service than if all facilities were placed into service at the same time.

C. Wellhead Price of the Gas

The average delivered price of Alaskan gas to the lower-48 states will include the ANGTS transportation cost of service and the wellhead price of the gas. The wellhead price of Prudhoe Bay gas is controlled by the Natural Gas Policy Act ("NGPA") at $2.13

per MMBtu as of January 1982, subject to continuing escalation for inflation. 24/

Whether price regulation of Prudhoe Bay gas is continued or not, the wellhead price obviously must be considered a potential variable if the gas is to be sold.

Assuming use of the traditional transportation cost of service tariff that I have described and a January 1982 wellhead price of $2.13 per MMBtu, the average price of Alaskan gas delivered to the lower-48 states in 1990 (in January 198 dollars/MMBtu) would be as follows:

First Year	$9.85
Five Year Average	8.40
Twenty Year Average	5.65

D. Cost Levelization

Up to this point, I have postulated certain delivered prices of Alaskan gas using a traditional transportation cost of service tariff and assuming NGPA wellhead pricing. If the availability and price of competing oil or gas are such that the delivered price of Alaskan gas would exceed the market clearing price, steps are available to meet the competition. As has been shown, traditional ratemaking practice results in a cost curve with high initial costs which rapidly decline thereafter in both nominal and real terms. In contrast, the real cost of competitive fuels is likely to be a gradually ascending curve, dependent on world

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24/ The current price, as of October 1983, is $2.34.

oil supply, pricing, Mid-East politics and potential major disruptions.

The technique used to alter the cost curve has been described as "levelization." After studying several alternatives, a methodology has been developed which would achieve the desired objective.

In summary, the methodology consists of two major elements. First, a deferral of some part of the wellhead price in the early years to be made-up with payments in later years. The producers will want to be satisfied that they will be able to obtain a satisfactory financial return over the life of the project before they will agree to enter into such an arrangement. Second, a reduced recovery of transportation costs in the early years by partially deferring depreciation and by capitalizing return on equity, a procedure which looks very promising to pipeline company sponsors. These two elements can be combined in varying degrees to achieve a target price--the market clearing price for natural gas. I have attached a graph to illustrate this concept related just to transportation costs (Attachment J). This shows the recovery of transportation costs resulting from a "cost levelization" process whereby certain costs are deferred and recovered later in the life of the project.

The results of our studies confirm that the average delivered cost of Alaskan gas to the lower-48 states can be levelized in a manner that would ensure marketability and provide an acceptable return on invested capital, based upon assumed market clearing prices. The result of a reasonable levelization scenario, compared to a traditional cost recovery pattern, is as follows:

Cost of Delivered Gas in 1990
(1982 $/MMBtu)

	Traditional Cost	Levelized Cost
First Year	$9.85	$5.00

Implementation of a levelized cost requires a negotiated agreement among lenders, equity sponsors, individual producers and individual shippers, and governmental approval. It is a complex negotiation, but we have made good progress toward agreement in every area. And we remain confident that it is achievable.

A brief comment is in order concerning the market clearing price as it relates to the cost of service. The cost of Alaskan gas delivered to the terminus of the Eastern and Western legs of the ANGTS can be considered a burner-tip price so long as no significant new transmission or distribution facilities are required for delivery to ultimate consumers. This is a valid assumption since Alaskan gas is considered to be a replacement for existing supplies rather than for growth in markets. Therefore, a levelized cost of Alaskan gas of approximately $5.00 per million Btu in 1990 (expressed in 1982 dollars) can be compared with current burner-tip market clearing prices of $4.00 to $4.50 per million Btu. This means that real cost increases in residual fuel oil prices, and, thereby, in market clearing prices, between now and 1990 would have to be in the range of 1.5

to 3.2% per year in order for Alaskan gas to be competitive. 25/

In summary, it should be recognized that the marketability of Alaskan gas can be controlled within a reasonable range by the willingness of the pipelines, producers, and lenders to adopt cost recovery flexibility to meet a given market clearing price.

25/ The required real increase in oil prices from 1983 to 1990 may be compared to the real price increases projected in DOE's world oil price scenarios, as shown in Attachment G. DOE's mid-range case (Scenario B) involves an increase of about 2.2% per year, and the range covered by all 3 scenarios extends from 0.2% to 4.5% per year for the period 1983-1990.

V. PROJECT FINANCING

A. Introduction

Project financing clearly is critically dependent upon demonstrable marketability of the gas. This is the first and foremost prerequisite. It will not be enough to show in the abstract that a "levelized cost" will permit delivering gas to the lower-48 states at a projected market clearing price. The financial community and the natural gas industry have always been conservative and reactive in nature due to the very large costs and permanency of transmission lines. And this is particularly true of any project of the magnitude of the ANGTS.

The most difficult part of the project to finance has been the Alaskan facilities due to the perceived difficulty of constructing in the Arctic and sub-Arctic and the magnitude of costs involved. In this part of my statement, I will examine the remaining criteria that must be satisfied before final financial commitments to construct the project realistically will be possible. But first I will briefly outline the fundamental requirements for financing, and the status of the constituent elements of a financing "package" as they have evolved to date.

B. Basic Requirements for Financing

The fundamental precepts for financing, established by the President and the Congress, are as follows: (1) that the project should be privately financed, (2) that equity investment in the project should be at risk, (3) that the burden of any cost overruns should be shared by equity holders and consumers upon completion through the application of the IROR, by providing a reduced return on common equity, and (4) that tariff charges could not commence prior to completion and commissioning of a major project element. This remains the basis for our continuing review of financing possibilities. Another basis, contained in an order of the FERC and agreed to by the pipeline company sponsors and the producers, is that the debt/equity ratio for investment in the project would be 75/25.

C. Elements of a Financing "Package"

The prospects for financing the Alaska elements of the ANGTS can be reviewed in terms of three constituent elements as follows:

1. Equity Contribution

The availability of equity contributions, equal to 25% of the amount to be financed, has never been an insurmountable obstacle. The pipeline and the producing company sponsors are among the largest companies in their respective industries and possess the financial capability to provide the equity capital to a project which attracts the necessary debt support and governmental cooperation. We have not closed the door to additional equity contributors.

2. Debt Capacity

The availability of sufficient debt funds had not been viewed as a significant obstacle to financing under the sponsors' original concept. In a letter to the sponsors in August 1981, a group of four major U.S. commercial banks providing financial advice stated that they believed, based on certain conditions, that the project could be privately financed without government guarantees or participation and that there would be adequate debt funds available to the project on a world-wide basis. They supported that statement with a detailed funding study.

3. Project Completion Credit Support

The banks also stated that after project completion and commencement of gas deliveries, pursuant to satisfactory tariff and tracking arrangements, the credit of the project itself would provide adequate assurance of debt service to the extent that sponsoring companies would not be obliged to any continuing pledge of corporate credit.

The banks further advised, however, that credit support for most of the debt would be required of the participating companies during the construction phase of the project. This was a major change from the concept that had been generally assumed by all parties involved in the ANGTS project up to that time, namely that a pre-committed pool of additional funds, i.e., a "completion assurance pool" to cover possible cost overruns, would be acceptable to lenders in lieu of corporate credit. The problem with this new requirement was that the transmission companies had a limited capability, after pledging their equity contributions, to provide corporate credit support for funds borrowed for construction due to existing bond indentures which prohibit any unconditional pledge of corporate assets. Nevertheless, the pipeline companies agreed in 1982 to make preliminary commitments to the extent of economic feasibility, and these commitments were verified by the banks in an examination of each participating company's financial structure. Regretfully, it was concluded in May 1982 that a sufficient combination of equity and credit support for debt was not available under the economic conditions prevailing at that time.

D. Remaining Prerequisites for Financing

Clearly, the status of the three financing elements, set forth above, is not the final answer. Conditions that can be reconsidered, in addition to the outlook for an improved economic climate, are: (1) the debt/equity ratio, (2) the respective shares of transmission company and producer participation, (3) the amount required to be financed, in light of cost reductions achieved, declines in the rates of interest, and a decline in inflation, and (4) the possibility of additional project participants, from both the private and public sectors. With regard to the amount to be financed, reductions in capital costs in base-year dollars lead to substantially greater reductions in the amount to be actually financed--a reduction estimated at about 1½ to 2 times the amount in base-year dollars.

Assuming that a levelized cost is agreed upon and assuming that conceptual agreement on a workable financing approach is completed among all parties, there still are several essential conditions that must be met in order for the project to go forward. First, the so-called "glut" of natural gas must be perceived to be ending, and gas buyers must again be entering the market seeking contracts for long-term assured commitments of gas reserves. Second, the current uncertainty of legislative action concerning gas pricing and deregulation must be resolved. Third, a clearer view of the future supply and price trend for world oil is necessary. Finally, it must be perceived by the financial community that the U.S. and Canadian governments wholeheartedly support the project and are doing all they can to clear away unnecessary obstacles in order to permit expeditious completion.

It should be noted that a number of major uncertainties that previously beset the project and inhibited financing already have been resolved. First, project design and planning have been brought to an advanced stage as a result of the hundreds of millions of dollars invested to date. Second, our cost estimating has been completed in unprecedented detail, has received an extraordinary degree of government review, and has been substantially approved. Third, the IROR mechanism, which took years to develop, is in place together with approved tariff and "tracking" procedures to ensure that the ANGTS transportation costs are recovered from natural gas company purchasers under all circumstances. Finally, regulatory uncertainty in many other key project areas has been eliminated as a result of the major government permits and design approvals we have obtained to date. In short, the years since 1977 have been well spent by the sponsors in preparing the project for implementation, with a minimum lead time, as soon as the market-related criteria I have described have been met.

VI. U.S. NATIONAL ENERGY SECURITY INTERESTS

Natural gas, as previously noted, provides about 26% of U.S. energy needs. Yet little more than a 9-year supply of proven domestic gas reserves (excluding Prudhoe Bay) exists, and any interruption in imported oil would immediately increase demand for natural gas. Despite the current short-term plentitude of oil and natural gas, we believe the day is not far off when Alaska's secure long-term supply of gas will be urgently required in the lower-48 states.

Prudhoe Bay natural gas remains vitally important to U.S. national security and domestic energy interests for the following reasons:

-- The ANGTS project, at full capacity, could deliver the energy equivalent of about 600,000 barrels a day of oil to the lower-48 States for more than 22 years. This is significant in light of the Paris-based International Energy Agency's ("IEA") warning, in October 1982, of a possible new oil crisis in the mid- to late- 1980s that would "deal a devastating blow" to major industrial countries. 26/

-- As discussed previously, there are increasing clear warning signs and solidly-founded projections of a natural gas shortage in the years immediately ahead in the U.S.

-- Prudhoe Bay natural gas truly constitutes a U.S. "strategic natural gas reserve," amounting to 15% of proven lower-48 reserves. In May 1983, the member nations of the IEA adopted a recommendation, reportedly backed by the U.S., which called for the "creation of strategic gas reserves in the 21 member countries of the IEA, which includes the U.S. This undertaking would parallel the massive

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26/ "The Deceptive Oil Glut," The Baltimore Sun, October 15, 1982, page A-16.

strategic petroleum reserves built up by industrialized nations in the 1970s...." 27/ In this setting, any suggestion of committing the 28 Tcf of proven, available North Slope gas reserves to foreign nations is unthinkable from a national security viewpoint.

-- Any system to deliver Alaskan North Slope natural gas to market will require a multi-billion dollar investment. In order to privately finance such a large investment in facilities, it is essential to first enter into long-term contracts for the sale of the gas. These contracts become the foundation for the marketability of the gas to assure lenders that repayment of funds will occur. Therefore, export of the gas would not be just a short-term commitment that could be terminated at will. Rather, it would be an irreversible commitment of the reserves to foreign markets, which would be further solidified if a foreign government were to be subsidizing the project.

-- The Congress, in creating a Synthetic Fuels Corporation, recognized the vulnerability of the U.S. to a future energy supply crisis. Recently it was reported that price guarantees for the plants to be supported by the Synthetic Fuels Corporation likely would cost the Treasury "80 to 90 percent" of the Corporation's original $15 billion appropriation. It was also reported that when all of these synfuel plants are in operation, they will produce only about 150,000 barrels of oil equivalent a day. 28/ It would be absurdly inconsistent to spend $15 billion to obtain this result while exporting a multi-decade proven supply of Alaskan North Slope gas equivalent to 600,000 barrels of oil a day.

-- If additions to U.S. gas reserves continue to decline and the nation is again faced with gas curtailments, the U.S. would be forced to seek increased gas imports from foreign nations, subject to their economic and political decisions.

27/ "West Moves to Counter Any Gas Cutoff," Wall Street Journal, June 21, 1983, page 39.

28/ "Synfuels Corp. to Commit $15 Billion to Projects," The Washington Post, April 2, 1983, page A1.

As discussed earlier in this statement, the ability and/or willingness of these nations to meet U.S. domestic energy requirements at reasonable prices is questionable.

-- The Canadian government repeatedly has been assured by the U.S. Executive Branch and Congress of U.S. intentions to complete the ANGTS, a system in which the Canadians have already invested about $975 million, including the "prebuilt" facilities. The ANGTS was the motivation for two formal U.S.-Canadian agreements, legislation in both countries, and a Joint Resolution of Congress in the Summer of 1981. The Canadians regard the system as a key to opening Canada's energy frontier in an area where great expenditures have been made in exploration and development. In a debate in the Canadian House of Commons on October 11, 1983, the Hon. Jean Cretien, Minister of Energy, Mines and Resources, made the following statement: "...we made a deal with the American administration many years ago, and I think it will want to keep its word. If the administration in Washington decides to take gas from Alaska to...markets it will use the Canadian route." 29/ Canada's long-term objective has been to lessen its reliance on politically unstable energy suppliers. If the ANGTS is not completed, Canadian-U.S. relations will be seriously impaired, with adverse consequences likely for other Canadian-U.S. joint security interests.

-- Commitment of the Prudhoe Bay reserves to foreign interests could also threaten the $1.5 billion U.S. investment in the "prebuilt" portion of the system, which is now capable of delivering about 450 Bcf a year to U.S. consumers; and a complex, contentious Canadian political and legal issue could be created regarding viability of the governing statute in Canada, the Northern Pipeline Act. The "prebuilt" portion of the system is regarded as a truly international energy project, and consultation between U.S. and Canadian officials on numerous and complex tariff, pricing, and throughput issues will commence shortly. 30/

29/ Canada, House of Commons, House of Commons Debates, Official Report, October 11, 1983, p. 27902.

30/ Hon. H. A. Olson, Canadian Minister of State for Economic Development, letter of October 7, 1983, to U.S. Energy Secretary Hodel, formally requesting "Consultations" pursuant to Articles 8 and 9 of the Agreement on Principles.

Continued progress on the Alaska project will protect the economic viability of the "prebuilt" portion.

-- The Congressional enactment of ANGTA and the subsequent decision by the President were predicated on an exhaustive national security analysis by the U.S. Department of Defense ("DOD"), the State Department, DOE, and the Congress. A Federal Task Force, chaired by DOD, reported to the President in 1977 on national security implications of various transportation systems for Alaskan natural gas. The conclusion was as follows: "The growing dependence of the nation upon imported oil presents a grave danger to the national security. The addition of the Alaskan North Slope natural gas to the energy matrix of the nation can help reduce the volume of imported oil requirements and thereby contribute to an improved national security posture. The completion of a transportation system for delivery of Alaskan North Slope natural gas to the contiguous 48 States must be considered an important national security objective...." (Emphasis added) 31/

The situation is fundamentally the same today, six years later. The U.S. remains highly dependent on foreign suppliers, and the proven reserves of North Slope natural gas are a unique, irreplaceable national asset.

31/ U.S. Department of Defense, Task Force on National Security Implications, Report on the Federal Power Commission Recommendations on Alaska Natural Gas Transportation System, 1977, page 6.

VII. CONCLUDING REMARKS

From a wide spectrum of respected sources, the warnings of a serious shortage of "conventional" natural gas in the lower-48 states in the years ahead have been clearly stated. The Congress and the American people are on notice. We have seriously erred in the past by assuming that currently perceived conditions will persist indefinitely, and there is a present danger that again we have been lulled into complacency with regard to natural gas. Because we live in a volatile, complex world, the exact timing of future events cannot be predicted with certainty. But we must not allow this to obscure the fundamental facts and trends that have been documented in this statement.

The proven reserves of natural gas at Prudhoe Bay remain the single largest block of such reserves under U.S. control. They constitute, in reality, a U.S. "strategic natural gas reserve" that parallels the U.S. Strategic Petroleum Reserve. These reserves, at present, lack deliverability to the lower-48 states. But a strong group of sponsor firms, both in the U.S. and Canada, has invested over $925 million--without government financial assistance--to do the advance planning and reduce to a practicable minimum the lead time required to construct the remaining elements of an overland pipeline transportation system.

Any alternative transportation system that might be proposed would not only have to duplicate that commitment and preparation, it would also have to resolve major new environmental challenges and contend with a formidable existing legal and regulatory framework which took years to put in place. And it would have to establish a new statutory basis. There is no reasonable likelihood that Alaskan North Slope gas can be delivered to market earlier by means other than the ANGTS project. For this reason, we are convinced that the ANGTS project remains in the best interest of not only the lower-48 states, but of Alaska as well.

The ANGTS sponsors remain committed to the project. They will continue their preparations and will move the project forward as soon as economic conditions permit. We have demonstrated our ability, through a major innovative design optimization, to effectuate substantial capital cost reductions; and other design and construction cost optimizations are under serious consideration. We have also demonstrated the "cost levelization" concept by which the gas could be delivered in 1990 at $5.00 per million Btus (in 1982 dollars); and this may be compared to current residual fuel oil prices of $4.00 to $4.50 per million Btus, which can be expected to escalate in real terms by 1990. The missing link is the fact that natural gas companies are not at this time in the market buying reserves to ensure future deliverability to their customers. This clearly is a temporary condition. Because of relatively low reserves-to-production ratios in the lower-48 states, there could well be a stampede back to the market for deliverable reserves as the temporary surplus of marketable gas is exhausted and supplies come into closer balance with demand.

The North Slope gas was committed to the ANGTS project several years ago by the President and the Congress, and the commitment extended to formal agreements with the Government of Canada that have been reconfirmed by two successive presidents. I want to emphasize that this is an international project, and it remains of great importance to Canada. The $2.2 billion already invested by Canadian and U.S. firms to complete and place into operation the "prebuilt" sections plus the $925 million invested on the remaining parts of the system is ample testimony to our reliance on these commitments and our dedication to the project. And, when Alaskan gas flows, the "prebuilt" facilities will have been substantially depreciated, with resultant decreased costs to consumers.

The magnitude of proved reserves involved, which permits only a single high-volume, long-life system, is essential to justify the enormous expense of constructing a transportation system from the North Slope of Alaska and, thereby, to market the gas. I want to assure the Committee that we will continue to work toward the day when the ANGTS project can be put into service for the benefit of all Americans.

Attachment A

Alaskan Segment
List of Key Engineering and Technical Data Collection Accomplishments

Test programs conducted in frost heave and pipe metallurgy, in coordination with government scientists and engineers, include the following:

- Fairbanks frost heave test facility with ten full-scale pipe test sections.
- Six chilled pipe facilities with twelve full-scale pipe test sections.
- Two differential heave full-scale pipe test sections.
- Eight soil uplift resistance field tests.
- Fifteen surface disturbance sites.
- Thirty-one uplift resistance and 260 frost heave laboratory tests.
- Two full-scale pipe burst tests - England.
- Seven full-scale burst tests - Canada.
- Five small-scale frozen backfill burst tests.
- Three full-scale pipe bend tests.

Field data programs completed, essential for design and reliable cost estimates, include:

- Pipeline centerline surveys - 727 miles.
- Soil resistivity surveys - 570 miles.
- Slope stability reconnaissance - 272 miles.
- Fault studies - 196 miles.
- Hydrographic surveys - 130 stream crossings.
- Aufeis studies - 3 years-pre/post breakup.
- Centerline borehole drilling - 1,856 holes.
- Mineral material sites drilling - 1,044 holes.

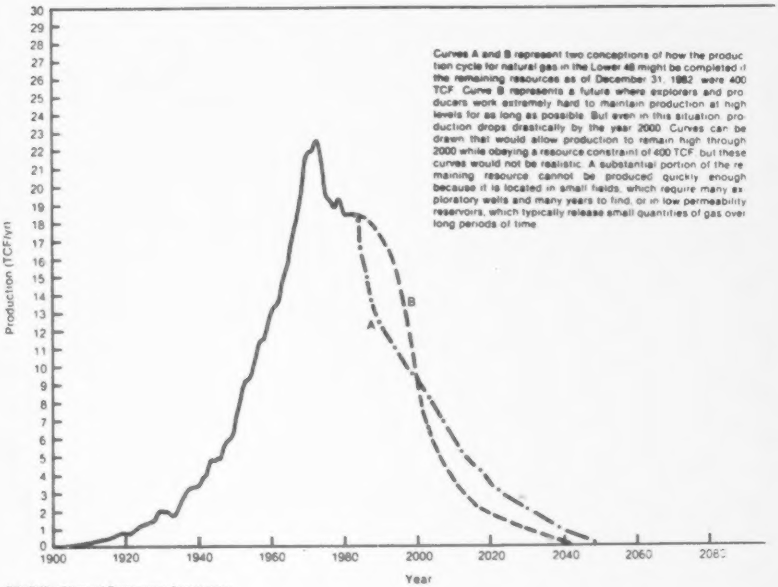
- Stations and other site drilling - 753 holes.
- Soil temperature measurement - 20,000 thermistors.

Key decisions are reflected in or derived from completed work products such as:

- The complete AGCF process and plant designs.
- Detailed pipeline alignment sheets.
- A computerized soils data base.
- Detailed structural analysis of the Yukon River Bridge.
- Purchase specifications for major material, e.g., mainline pipe, valves, refrigeration system, turbine/compressors.
- A thermal transient-flow model, with work continuing on a complementary heat transfer model.
- Over 1000 hydraulic simulation studies evaluating the major system variables and leading to an optimum economic design.
- Approval of 28 of 30 sections of the Pipeline Design Criteria Manual, with the remaining 2 OFI approvals expected shortly.
- Design Criteria Manuals for: (1) Telecommunciations, and (2) Compressor and Metering Stations.

Attachment B

Alternative Concepts of the Natural Gas Production Cycle if Remaining Resources = 400 TCF
(conventional gas only)



Curves A and B represent two conceptions of how the production cycle for natural gas in the Lower 48 might be completed if the remaining resources as of December 31, 1982 were 400 TCF. Curve B represents a future where explorers and producers work extremely hard to maintain production at high levels for as long as possible. But even in this situation, production drops drastically by the year 2000. Curves can be drawn that would allow production to remain high through 2000 while obeying a resource constraint of 400 TCF, but these curves would not be realistic. A substantial portion of the remaining resource cannot be produced quickly enough because it is located in small fields, which require many exploratory wells and many years to find, or in low permeability reservoirs, which typically release small quantities of gas over long periods of time.

SOURCE: Office of Technology Assessment

Reprinted from U.S. Natural Gas Availability, Conventional Gas Supply Through The Year 2000, Office of Technology Assessment, September 1983, page 6.

Attachment C

A Comparison of Conventional Lower 48 Natural Gas Supply Forecasts (TCF)

Company	1985	1990	1995	2000
1. Gulf	19.4	18.8	16.7	13.8
2. Texaco	18.9	16.1	14.0	13.0
3. Chevron	18.2	18.0	16.5	14.0
4. Exxon	—	14.6	—	14.1
5. Shell[a]	17.0	13.9	11.5	8.9
6. Conoco[b]	19.0	18.0	—	14.6
7. Union	19.2	18.0	—	—
9. Standard Oil (Indiana)[c]	18.5	17.7	15.5	15.5
10. Tenneco	18.0	15.4	13.5	11.9
11. ANR	15.5	13.6	—	—
12. AGA	16.0-18.0	15.0-17.0	13.5-15.5	12.0-14.0
13. GRI	17.9	15.1	12.8	11.6
14. DOC[c]	—	—	—	12.8
15. GAO	16.5	14.8	14.0	13.5
16. E. Erikson	17.4-18.5	—	—	—
17. EIA	17.3	14.9	14.0	—
18. ICF	16.1	14.3	12.4	—
19. IEA/OECD[b]	16.5-18.0	14.0-17.0	—	11-15
20. Chase Bank[b]	18.3	17.7	—	—
Average	18.1	16.8	15.3	14.3

[a] Marketed gas rather than actual total (dry) production. Excludes increased production from fields that are "forever controlled" under NGPA and that Shell believes could be obtained with decontrol.

[b] Numbers include tight sands.

[c] Averages include interpolated data.

REFERENCES:

1. Gulf Oil Corp., U.S. Energy Analysis Task Group, Pittsburg, Pa., *U.S. Environmental Assessment 1982 Scenarios*, June 1982. "Business as Usual" scenario (includes Lower 48 and southern Alaska.)
*2. Texaco Inc., Economics Division, Finance and Economics Department, White Plains, N.Y., *United States Energy Outlook 1980-2000*, February 1981 (Forecast of Marketed Production.)
*3. Standard Oil Co. of California, Economics Department, San Francisco, Calif. Preliminary forecast from forthcoming publication.
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*5. Shell Oil Co., Exploration and Production Economics Department, Houston, Tex., *National Energy Outlook to the Year 2000*, July 1982 (Fall 1981 Analysis Dry Marketed Gas.)
*6. Conoco, Inc., Coordinating and Planning Department, Stamford, Conn. *World Energy Outlook Through 2000*, January 1982.
*7. Union Oil Co., Oil and Gas Division, Planning and Valuation, Los Angeles, Calif.
*8. Marathon Oil Co., Economics Department, Findley, Ohio.
*9. Standard Oil Co. (Indiana), Chicago, Ill. Amoco's forecast includes nonhydrocarbon gases and is specifically done on a dry gas basis. Its 1985 forecast number is demand-constrained.
*10. Tenneco Gas Transmission Co., Economic Analysis and Long Range Planning Department, Houston, Tex., *Energy 1982-2000*, August 1982.
*11. American Natural Resources Co., Detroit, Mich., *United States Energy Outlook 1980-2000*.
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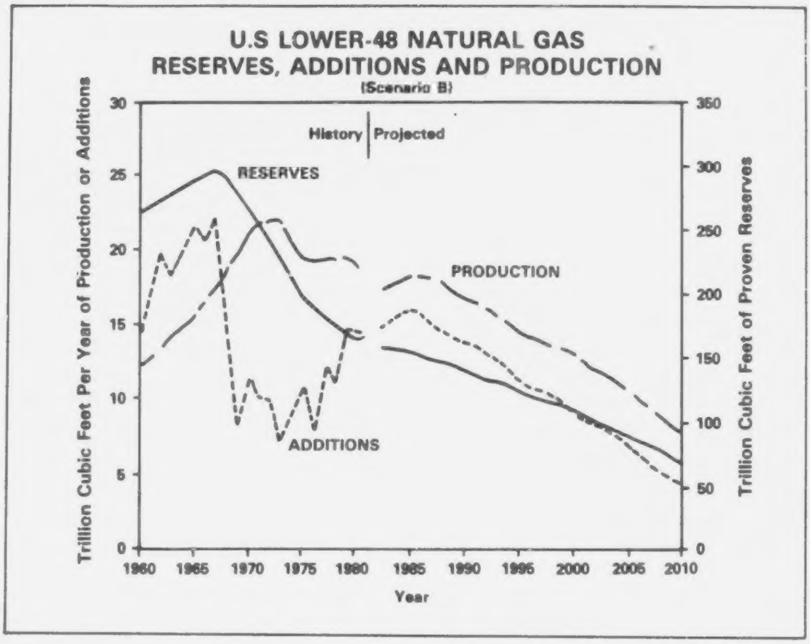
SOURCE: Jensen Associates, Inc., *Understanding Natural Gas Supply in the United States*, Contractor Report to the Office of Technology Assessment, April 1983.

Reprinted from U.S. Natural Gas Availability, Conventional Gas Supply Through The Year 2000, Office of Technology Assessment, September 1983, page 95.

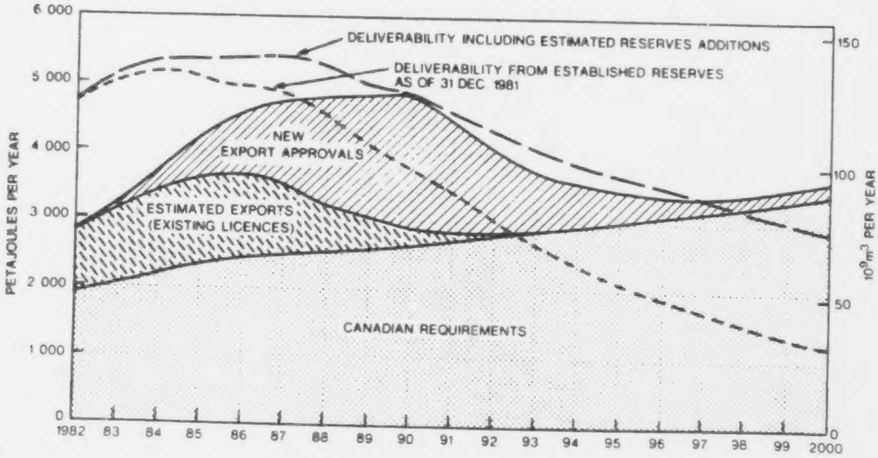
Attachment D



Reprinted from Energy Projections to the Year 2010, U.S. Department of Energy, October 1983, page 1-20.

Attachment E

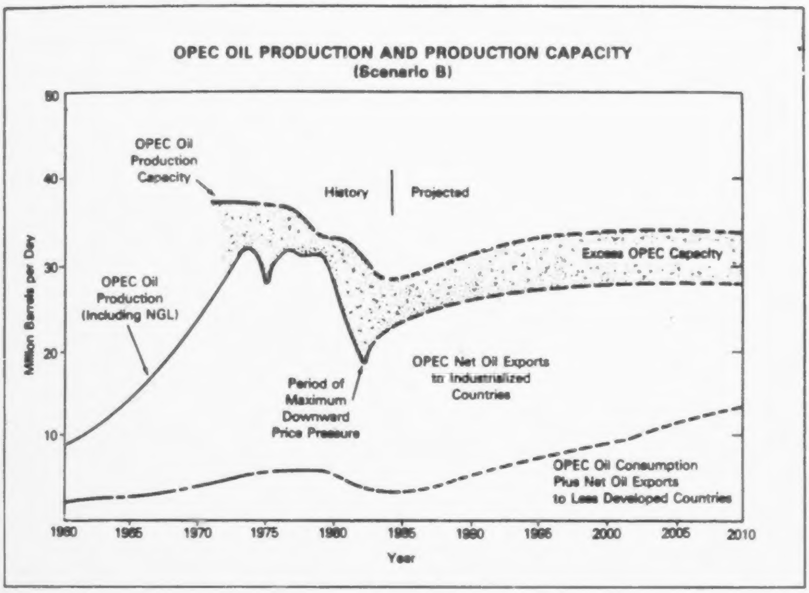
Deliverability Appraisal of Canadian Gas and Availability for Export



Reprinted from National Energy Board, Reasons for Decisions...of the Gas Export Omnibus Hearing, 1982, January 1983, page 85.

Comment: It should be noted that from 1998 onward, Canadian domestic requirements are projected to exceed deliverability. The shortfall, plus the small remaining amounts covered by export licenses, will be made up by deliverability not used in the early years. It should also be noted that these projections rely heavily on "Estimated Reserves Additions," which include the discovery of new pools of gas.

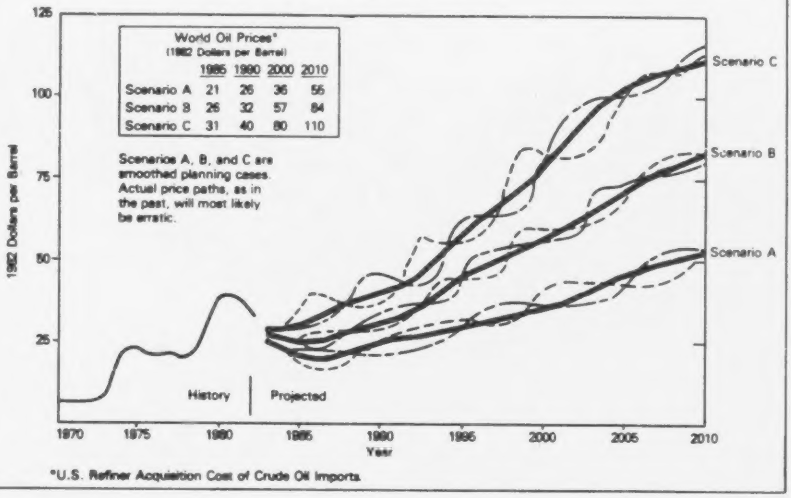
Attachment F



Reprinted from Energy Projections to the Year 2010, U.S. Department of Energy, October 1983, page 5.

Attachment G

NEPP-1983 WORLD OIL PRICE SCENARIOS*



World Oil Prices* (1982 Dollars per Barrel)	1985	1990	2000	2010
Scenario A	21	26	36	56
Scenario B	26	32	57	84
Scenario C	31	40	80	110

Scenarios A, B, and C are smoothed planning cases. Actual price paths, as in the past, will most likely be erratic.

*U.S. Refiner Acquisition Cost of Crude Oil Imports.

Reprinted from Energy Projections to the Year 2010, U.S. Department of Energy, October 1983, page 6.

Comment: The specific figures, in constant 1982 dollars, associated with each scenario may be found in Table 5-2 of the DOE publication, page 5-6. It should be noted that even Scenario A involves a real increase in world oil prices for the period 1983-1990.

NORTHWEST ALASKAN PIPELINE COMPANY

Alaskan Pipeline

Attachment H

Contact: J. N. Vallely, vice president, Corporate Communications
Tel. (801) 584-7069

FOR IMMEDIATE RELEASE

ANGTS SPONSORS ANNOUNCE RESULTS OF NEW CONDITIONING PLANT STUDY

SALT LAKE CITY, AUG. 2 -- Northwest Alaskan Pipeline Company, representing the sponsors of the Alaska Natural Gas Transportation System (ANGTS), today announced that almost $1 billion can be saved in the cost of a natural gas conditioning plant to be constructed at Prudhoe Bay, Alaska. The saving stems from adoption of a new process and represents approximately a 25% reduction in cost for the multi-billion dollar plant.

The conditioning plant is an integral part of the 4,800-mile Alaskan natural gas pipeline system that will tap North Slope Alaskan gas reserves and deliver them to markets in the lower 48 states.

According to John G. McMillian, chairman and chief executive officer of Northwest Alaskan Pipeline Company, "adoption of the BASF Activated MDEA process will save over $900 million, measured in 1981 dollars and compared to our previous cost estimates. Further, when you consider inflation and financing costs, the actual savings will be much higher."

"There will also be significant savings in operating costs and reduced space requirements at Prudhoe Bay," McMillian said.

Northwest Alaskan's previous cost estimate for the conditioning plant was approximately $4 billion, compared to the new estimate of about $3 billion, both in June 1981 dollars, he said.

McMillian said the decision to adopt the BASF process, which was developed in West Germany, followed 9 months of intensive evaluation and engineering work. It will require only two annual sealifts to Prudhoe Bay during construction in contrast to the three previously planned.

Other studies already underway could also lead to significant savings in building and operating the overall ANGTS system, he said.

Northwest Alaskan Pipeline Company is a wholly-owned subsidiary of Northwest Energy Company, a major interstate supplier of natural gas to the Pacific Northwest and Intermountain region and to the Mid-Continent area of the U.S.

Other project sponsors include Exxon, ARCO and Sohio and subsidiaries of the following major natural gas transmission companies: Pacific Gas & Electric Co., InterNorth, Inc., Pacific Lighting Corporation, Panhandle Eastern Pipe Line Company, Columbia Gas Transmission Corporation, Texas Eastern Transmission Corporation, TransCanada PipeLines and United Gas Pipeline Company.

-0-

From: Northwest Energy Company
P. O. Box 1526
Salt Lake City, Utah 84110-1526

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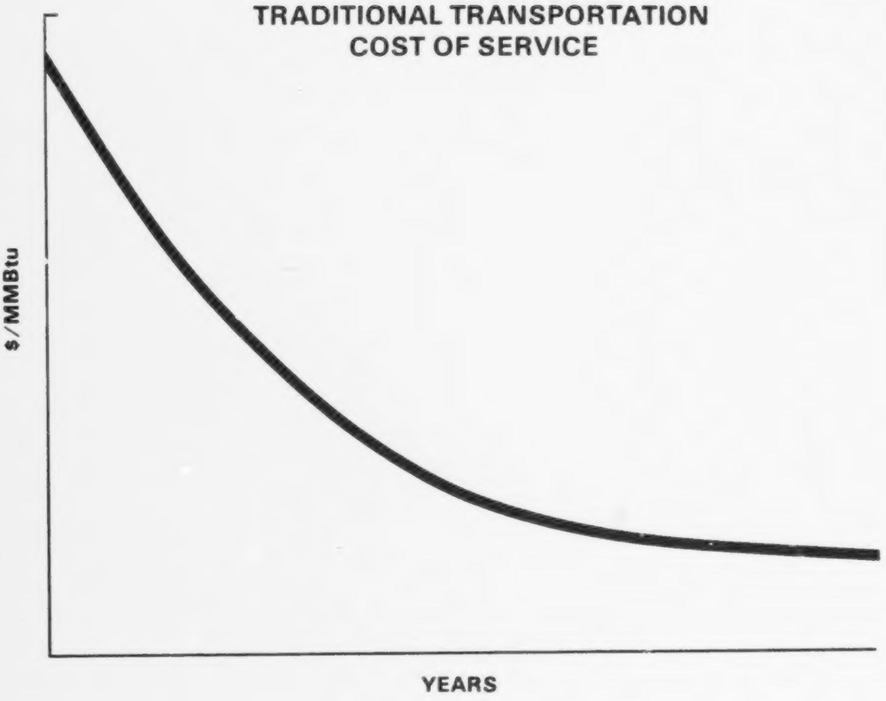
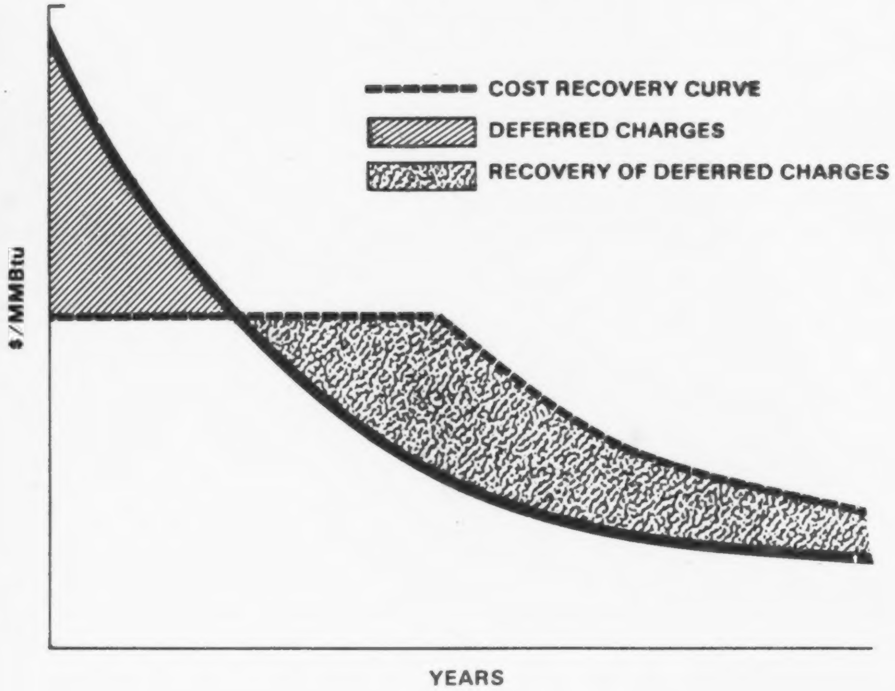
Attachment I



TRADITIONAL TRANSPORTATION COST OF SERVICE

Attachment J

CONCEPT OF LEVELIZED TRANSPORTATION COST OF SERVICE



Note: "The Recovery of Deferred Charges", in present value terms, is equal to the "The Deferred Charges".

Senator MURKOWSKI. Thank you very much, Mr. Jones. We appreciate a very complete update on the project on behalf of the sponsors who are involved with your company, the Northwest Energy Co., and it's reassuring to have that current update and the reassurance that you are in support of continuation of the ANGTS project under the franchise.

Mr. Pierce, it's a pleasure to welcome you before the committee. We ask that you go ahead with your testimony. Mr. Pierce is chairman of the Foothills Pipeline Co., Ltd., Calgary, Alberta.

STATEMENT OF ROBERT L. PIERCE, PRESIDENT AND CHIEF EXECUTIVE OFFICER, FOOTHILLS PIPELINE CO., LTD., CALGARY, ALBERTA, ACCOMPANIED BY BRUCE SIMPSON, SENIOR VICE PRESIDENT AND DIRECTOR, FOOTHILLS PIPELINE CO, LTD.; AND MURRY PETERSON, SENIOR VICE PRESIDENT, FOOTHILLS PIPELINE CO., LTD.

Mr. PIERCE. Mr. Chairman, it's a pleasure to see you again. for the record, I am president and chief executive officer and a member of the board of directors of Foothills Pipelines which is the Canadian company responsible for the Canadian segment of the Alaska Natural Gas Transportation System. Appearing with me today, Mr. Bruce Simpson, the senior vice president and director of Foothills and Mr. Murry Peterson who is a senior vice president.

Senator MURKOWSKI. I recognize you both.

Mr. PIERCE. Mr. Jones has provided an excellent summary of the progress which has been made in the United States toward the successful financing and completion of the program. We will simply submit our statement for the record and provide a brief oral summary of the parallel progress which has been made in Canada.

Senator MURKOWSKI. It will be submitted in the record as if read, and I will remind the other witnesses to summarize their remarks. They will also be submitted in the record as if read.

Mr. PIERCE. Thank you Mr. Chairman. In so doing we will highlight congressional actions, international commitments and regulatory findings which provide the foundation for our ongoing investment in the program.

The President's 1977 decision selecting the project was based upon a factual finding that a conventional overland pipeline, which follows the TAPS oil pipeline corridor and then the Alaska Highway, and which utilizes the resources and expertise of existing Canadian companies, is the most economic and environmentally sound means of transporting Alaskan gas to markets in the lower 48 States. In addition, however, the President placed extreme importance on the ability of the system to provide the United States with additional Canadian imports over the short term, through prebuilding the southern portions of the project prior to deliveries of Alaskan gas.

Following through on this concept, the Federal Energy Regulatory Commission issued a series of decisions in 1980, finding that prebuilding portions of the project would clearly be in the public interest of the United States. Among other things the Commission found that prebuilding would decrease the total cost of the project, improve its prospects for private financing, and reduce the eventual cost of service for consumers of Alaskan gas. In Canada, however, the Government was initially reluctant to approve the prebuild phase without assurances that, upon completion of the southern facilities and the commencement of substantial new exports through these facilities, the United States would remain committed to the completion of the entire project in accordance with the 1977 Agreement on Principles.

In order to provide the assurances requested by Canada, Congress passed a bipartisan and practically unanimous joint resolution on July 1, 1980, declaring that the entire ANGTS is an essential part of securing this Nation's energy future and, as such, enjoys the highest level of congressional support for its expeditious construction and completion. The joint resolution also expressly encouraged prebuilding because it would, "contribute to the completion of the entire System and enable this Nation to obtain Canadian natural gas to displace 200,000 barrels of foreign oil per day."

Based upon these commitmetns and various Canadian authorizations, Foothills has invested approximately $1 billion (Canadian) in prebuilding 530 miles of the Canadian segment of the project, and Canadian producers have invested a similar amount in necessary production and gathering facilities. In addition, U.S. companies have invested approximately $1.5 billion in prebuilding approximately 1,000 miles of the lower 48 segments. These pipeline facilities, which we refer to as phase I of the NAGTS, were completed on time and within cost estimates, and they are currently providing the service which the United States has found to be in its public interest.

Concurrent with the work on phase I, Foothills has made substantial progress on phase II, which involves the remainder of the system. Detailed route location work for the entire pipeline has been completed; pipe burst tests have been successfully concluded; extensive geotechnical, frost heave, and environmental studies have been undertaken; and design work is at an advanced stage. To date, our expenditures on phase II total approximately $285 million (Canadian).

In addition to these accomplishments, Foothills is presently engaged in several studies which are aimed at finding new means of reducing the capital costs of the Canadian segment. We are hopeful that significant savings can be achieved through design changes in such areas as frost heave and pipe pressure. Moreover, like the U.S. sponsors, we are exploring the feasibility of shortening the construction schedule from 6 years to 5 years.

Senator MURKOWSKI. I'm sorry, I didn't hear that. Your construction schedule?

Mr. PIERCE. From 6 to 5 years for the portion that has not been completed.

Senator MURKOWSKI. From when?

Mr. PIERCE. From whenever the start date is.

Senator MURKOWSKI. From whenever they start it will take—

Mr. PIERCE. Five years is what we would now state.

Senator MURKOWSKI. FIve years from now to complete it?

Mr. PIERCE. Essentially, if we had the go-ahead today.

Senator MURKOWSKI. So you figure a 5-year project from the time you get the go-ahead, is what you're saying?

Mr. PIERCE. Right.

Senator MURKOWSKI. Thank you.

Mr. PIERCE. Substantial progress has also been made during the past 6-years by the Canadian Government. Indeed, within 5 months after congressional ratification of the President's 1977 decision selecting the project, the Canadian Parliament enacted the Northern Pipeline Act, which gave full force and effect to the agreement on principles which had been signed by our two countries. Among other things, that act granted final certificates of public convenience and necessity to Foothills; it established procedures and standards for the filing and review of Foothills' tariff; and it restricted judicial review of decisions issued by the National Energy Board in connection with the pipeline.

The Northern Pipeline Act also established the Northern Pipeline Agency, and vested it with both the responsibility and the authority to oversee the construction of the pipeline in Canada. Pursuant to that authority, the agency commenced operations at a very eary date, and has subsequently issued final terms and conditions on the technical, socio-economic and environmental aspects of most of the pipeline.

The National Energy Board has also worked aggressively to expedite the Canadian regulatory process. It has issued necessary approvals for phase I of the project; established an incentive rate of return mechanism pursuant to the agreement on principles; and issued orders on both the mainline and prebuild tariffs of Foothills. Indeed, the only significant regulatory hurdle remaining before the NEB is approval of the final design cost estimate and a financing plan for the remainder of the Canadian segment.

With respect to financing, it has long been recognized that the Canadian segment entails fewer construction risks than the Alaskan segment, because it involves conventional construction by existing Canadian companies who have a proven track record of successfully installing thousands of miles of pipeline facilities in western Canada. In light of this record, and our recent success with the completion of the prebuild phase, we are confident that financing for phase II of the Canadian segment will be put in place on a schedule which coincides with the financing of the Alaskan segment.

In short, Mr. Chairman, the Canadian sponsors and the Canadian Government have made consistent and substantial progress toward the completion of the ANGTS. Month-by-month, year-by-year, our company has remained capable of meeting any schedule which is established for the completion of the Alaskan segment of the project.

To our great regret, the combination of an economic downturn and a deliverability surplus in lower 48 gas reserves has caused the targeted completion date of the project to be delayed. Foothills is still firmly committed to the project, however, and it will continue its commitment for as long as the U.S. sponsors and the U.S. Government do their respective parts in bringing the project to early fruition.

Finally, Mr. Chairman, let me close by assuring you and the other members of the subcommittee that our company continues to be pleased to be associated with the new management of Northwest

Energy. The Williams Companies, which is now providing leadership to Northwest and the project has a long-standing reputation for excellence, and they too will be a positive force in moving the ANGTS toward completion.

That completes my prepared statement, Mr. Chairman. If you or other members have questions, I will be happy to respond.

[The prepared statement of Mr. Pierce follows:]

BEFORE THE
UNITED STATES SENATE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY REGULATION

Prepared Statement
of
ROBERT L. PIERCE
President and Chief Executive Officer
of
FOOTHILLS PIPE LINES (YUKON) LTD.

November 16, 1983

Mr. Chairman, my name is Robert L. Pierce, and I am President, Chief Executive Officer, and a member of the Board of Directors of Foothills Pipe Lines (Yukon) Ltd., the Canadian company which is responsible for the Canadian segment of the Alaska Natural Gas Transportation System ("ANGTS"). I am also Executive Vice President and a member of the Board of Directors of NOVA, AN ALBERTA CORPORATION, which owns fifty percent of the outstanding common shares of Foothills' capital stock. The other half of Foothills' common shares is owned by Westcoast Transmission Company Limited.

The representatives of Northwest Energy Company have provided an excellent summary of the progress which has been made in the United States toward the successful financing and completion of the ANGTS. For my part, I would like to briefly describe the parallel progress which has been made in Canada. In so doing, I will highlight the congressional actions, international commitments, and regulatory findings which have provided the foundation for our ongoing investment in the project.

As you will recall, Congress passed the Alaska Natural Gas Transportation Act ("ANGTA") in 1976. In that Act, Congress expressly found that "the expeditious construction of a viable natural gas transportation system for delivery of Alaska natural gas to United States markets is in the national interest". 1/ To that end, the Act established a procedural framework which would permit the President and Congress to select the best transportation system for Alaskan gas, but only after a thorough analysis and comparison of various alternatives.

In 1977, following extensive regulatory hearings and the review of recommendations by various federal agencies, the United States took three major steps toward the final selection of the project currently known as the ANGTS. First, the U.S. government signed an Agreement on Principles with the Canadian government relating to the construction and operation of the project. Second, in accordance with the provisions of ANGTA, the President issued a decision selecting the trans-Canadian ANGTS which was co-sponsored by Northwest and Foothills. And, finally, the Congress issued a joint resolution ratifying the President's decision.

The President's decision was based upon a factual finding that a conventional overland pipeline, which follows the TAPS oil pipeline corridor and then the Alaska Highway, and which utilizes the resources and expertise of existing Canadian companies, is the most economic and environmentally sound means of transporting Alaskan gas to markets in the lower forty-eight states. In addition, however, the President placed great importance on the ability of the

ANGTS to provide the United States with additional Canadian imports over the short term, through "prebuilding" the southern portions of the project prior to deliveries of Alaskan gas. [2]

Following through on this concept, the Federal Energy Regulatory Commission issued a series of decisions in 1980, finding that "prebuilding" portions of the project would clearly be in the public interest of the United States. Among other things, the Commission found that prebuilding would decrease the total cost of the project, improve its prospects for private financing, and reduce the eventual cost of service for consumers of Alaskan gas. In Canada, however, the government was initially reluctant to approve the prebuild phase without assurances that, upon completion of the southern facilities and the commencement of substantial new exports through these facilities, the United States would remain committed to the completion of the entire project in accordance with the 1977 Agreement on Principles.

In order to provide the assurances requested by Canada, Congress passed a bipartisan and practically unanimous joint resolution on July 1, 1980, declaring that the entire ANGTS is "an essential part of securing this Nation's energy future and, as such, enjoys the highest level of congressional support for its expeditious construction and completion...." [3] The joint resolution also expressly encouraged "prebuilding", because it would "contribute to the completion of the entire System ... and ... enable this Nation to obtain Canadian natural gas to displace two hundred thousand barrels of foreign oil per day." [4]

Based upon these commitments and various Canadian authorizations, Foothills has invested approximately one billion dollars (Canadian) in prebuilding 530 miles of the Canadian segment of the project, and Canadian producers have invested a similar amount in necessary production and gathering facilities. In addition, U.S. companies have invested approximately $1.5 billion in prebuilding approximately 1000 miles of the lower forty-eight segments. These pipeline facilities -- which we refer to as Phase I of the ANGTS -- were completed on time and within cost estimates, and they are currently providing the service which the United States has found to be in its public interest.

Concurrent with the work on Phase I, Foothills has made substantial progress on Phase II, which involves the remainder of the system. Detailed route location work for the entire pipeline has been completed; pipe burst tests have been successfully concluded; extensive geotechnical, frost heave, and environmental studies have been undertaken; and design work is at an advanced stage. To date, our expenditures on Phase II total approximately $285 million (Canadian).

In addition to these accomplishments, Foothills is presently engaged in several studies which are aimed at finding new means of reducing the capital costs of the Canadian segment. We are hopeful that significant savings can be achieved through design changes in such areas as frost heave and pipe pressure. Moreover, like the U.S. sponsors, we are exploring the feasibility of shortening the construction schedule from six years to five years.

Substantial progress has also been made during the past six years by the Canadian government. Indeed, within five months after congressional ratification of the President's 1977 decision selecting the project, the Canadian Parliament enacted the Northern Pipeline Act, which gave full force and effect to the Agreement on Principles which had been signed by our two countries. Among other things, that act granted final certificates of public convenience and necessity to Foothills; it established procedures and standards for the filing and review of Foothills' tariff; and it restricted judicial review of decisions issued by the National Energy Board in connection with the pipeline.

The Northern Pipeline Act also established the Northern Pipeline Agency, and vested it with both the responsibility and the authority to oversee the construction of the pipeline in Canada. Pursuant to that authority, the agency commenced operations at a very early date, and has subsequently issued final terms and conditions on the technical, socio-economic, and environmental aspects of most of the pipeline.

The National Energy Board has also worked aggressively to expedite the Canadian regulatory process. It has issued necessary approvals for Phase I of the project; established an incentive rate of return mechanism pursuant to the Agreement on Principles; and issued orders on both the mainline and prebuild tariffs of Foothills. Indeed, the only significant regulatory hurdle remaining before the NEB is approval of the final design cost estimate and a financing plan for the remainder of the Canadian segment.

With respect to financing, it has long been recognized that the Canadian segment entails fewer construction risks than the Alaskan segment, because it involves conventional construction by existing Canadian companies who have a proven track record of successfully installing thousands of miles of pipeline facilities in western Canada. In light of this record, and our recent success with the completion of the prebuild phase, we are confident that financing for Phase II of the Canadian segment will be put in place on a schedule which coincides with the financing of the Alaskan segment.

In short, Mr. Chairman, the Canadian sponsors and the Canadian government have made consistent and substantial progress toward the completion of the ANGTS. Month-by-month, year-by-year, our company has remained capable of meeting any schedule which is established for the completion of the Alaskan segment of the project.

To our great regret, the combination of an economic downturn and a deliverability surplus in lower forty-eight gas reserves has caused the targeted completion date of the project to be delayed. Foothills is still firmly committed to the project, however, and it will continue its commitment for as long as the U.S. sponsors and the U.S. government do their respective parts in bringing the project to early fruition.

Finally, Mr. Chairman, let me close by assuring you and the other members of the subcommittee that our company continues to be pleased to be associated with the new management of Northwest Energy. The Williams Companies, which is now providing leadership to Northwest and the project, has a long-standing reputation for excellence, and they, too, will be a positive force in moving the ANGTS toward completion.

That completes my prepared statement, Mr. Chairman. If you or other members have questions, I will be happy to respond.

Notes

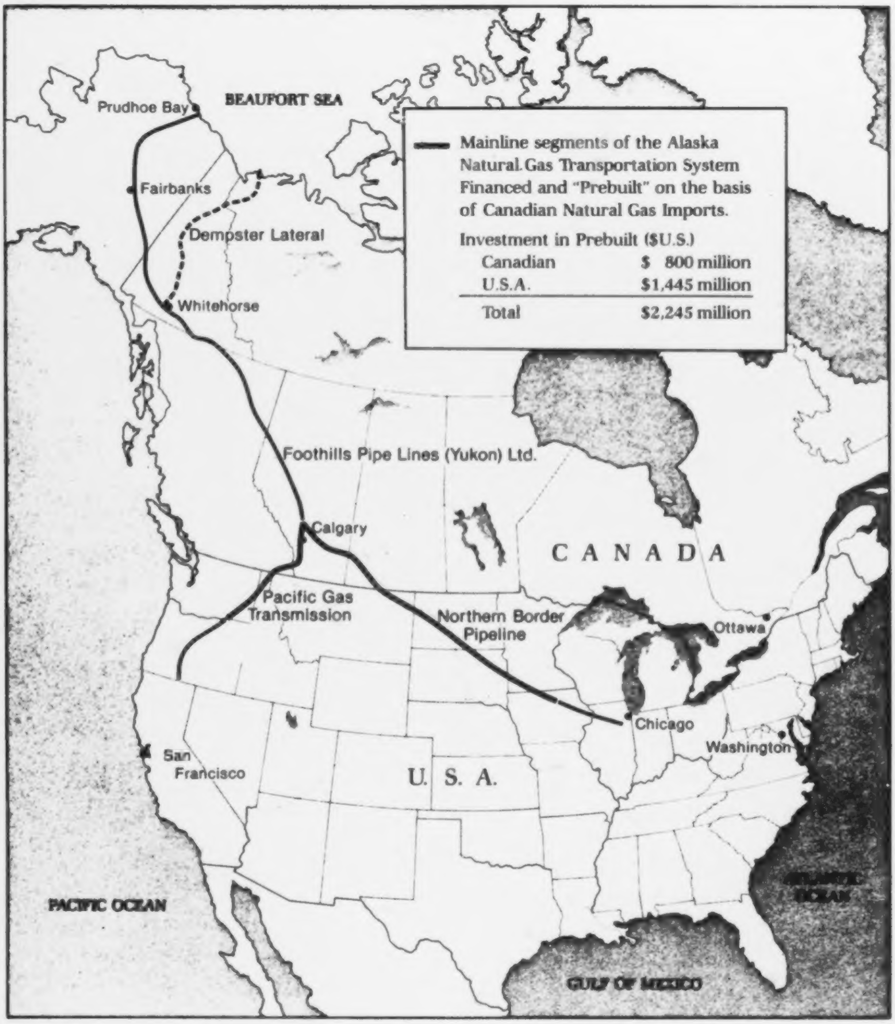
1/ The Alaska Natural Gas Transportation of Act of 1976, 15 U.S.C. 719.

2/ Decision and Report to Congress on the Alaska Natural Gas Transportation System, issued by the President on September 22, 1977 (p. xii).

3/ S. Con. Res. 104, 96th Cong., 2d Sess., 126 Cong. Rec. 5942 (July 1, 1980).

4/ Ibid.

THE ALASKA NATURAL GAS TRANSPORTATION SYSTEM


Prudhoe Bay
BEAUFORT SEA
Fairbanks
Dempster Lateral
Whitehorse
Mainline segments of the Alaska Natural Gas Transportation System Financed and "Prebuilt" on the basis of Canadian Natural Gas Imports.
Investment in Prebuilt ($U.S.)
Canadian $ 800 million
U.S.A. $1,445 million
Total $2,245 million
Foothills Pipe Lines (Yukon) Ltd.
Calgary
CANADA
Pacific Gas Transmission
Northern Border Pipeline
Ottawa
Chicago
Washington
San Francisco
U. S. A.
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO

Senator MURKOWSKI. Thank you, Mr. Pierce. I appreciate your testimony and reassurance that you and your associates with regard to the dedication to the completion of this project.

I might ask you specifically with regard to your interpretation of the commitments and obligations and the form of the agreement between the United States and Canada which in effect caused the Canadian Government to basically approve of an American line going through Canada, that there were certain conditions and obligations and one was that the United States pursue promptly the construction and provide assistance for the construction of the Alaska portion. Obviously that has not occurred, and it's my understanding the Canadian Government has expressed at times its unhappiness with that. Could you enlighten us a little bit more on the current posture of the Canadian Government? Obviously you don't have a Canadian Government witness, but I would say of the witnesses here you would be the most appropriate one to address that issue.

Mr. PIERCE. Well, Mr. Chairman, I hesitate at any time to speak in relation to any government, but I think fortunately before you is a statement filed by the Canadian Government and I think that would be the best indication of where matters stand.

Senator MURKOWSKI. I'm not going to let you off that easy. It's certainly an adequate answer.

The testimony of Mr. Jones indicated the anticipated price of Alaskan gas when it does come to the market might be in the area of $5 per million Btu. It's my understanding that the Canadian gas is presently going through the prebuild and while it's at the price of $4.40, that seems to be the prevailing price. There seems to be some latitude in that price structure.

I'm wondering in view of that substantial difference why you feel it's likely that the problems of Alberta particularly wouldn't want to continue with the contractual relationship that it presently enjoys to provide gas for the prebuild section.

Mr. PIERCE. I think the problems of Alberta, very much we'd like to not only continue with the present relationship but have full volumes taken under it, Mr. Chairman. The problem in the United States today is that the volumes aren't being taken that were contracted for reasons that Northwest has already indicated. But I think we have to appreciate, the only gas that can come into the United States from Canada is that which is approved by the National Energy Board and the Cabinet of Canada and by your FERC and Economic Regulatory Agency. And without those approvals, there is no gas that comes in.

Senator MURKOWSKI. Might you also conclude if Canada through its national energy policy wanted to dictate that the Alaska portion be built, that it curtail the export of Canadian gas into the United States, which would perhaps enhance the construction of the Alaskan portion, being the deduction that there would be no other alternative source of gas that could supply the market that is currently being supplied by Canadian gas from Alberta?

Mr. PIERCE. Well, Mr. Chairman, that's an interesting conjecture. Canadian gas, the full volumes are taken, but not serving more than 5 percent of the existing U.S. market at full volume. The amount of Canadian gas that goes into the market today is not any more than what initial flows would be through the Alaska system. I think the evidence that I have seen as being filed before you indicates, and I think Northwest says so, that in their view, all of the Alaskan gas and whatever Canadian gas can be obtained will be required in the lower 48 market, and that the lower 48 market is the place where it really can be absorbed. So in short, I don't think shutting off Canadian imports would bring Alaskan gas to market any sooner. As a matter of fact, I believe that all of the gas that can be obtained from Canada as an import and the Alaskan gas will be needed in the lower 48.

Senator MURKOWSKI. In that timeframe——

Mr. PIERCE. In the timeframe that we have been talking about, Mr. Chairman. And I think there is a finding from the American Gas Association indicating their assessment in the 1990 version.

Senator MURKOWSKI. What is the current status of contractual arrangements with Alberta or those companies that provide gas from Alberta through the prebuild? It's my understanding initially it was a 6-year contract and then that was extended not too long ago for an additional timeframe.

Mr. PIERCE. There were imports approved on the Canadian side on the extension of that contract.

Senator MURKOWSKI. For how long?

Mr. PIERCE. Through 1992, but they have not been dealt within the United States. So the status of the existing contract as of today is to 1988, until November of next year by agreement takes have been reduced to 40 percent.

Senator MURKOWSKI. It's been reduced——

Mr. PIERCE. By agreement between the parties. And yesterday I think it was 400 million going through the Foothills prebuild which was built——

Senator MURKOWSKI. And the combination, it's not that more gas might not be available from Alberta if there were a market to utilize that gas.

Mr. PIERCE. I think that's right, Mr. Chairman. We have invested roughly $285 million in the Alaska project and our assessment has always been that gas would have to go into a market on a competitive basis.

Senator MURKOWSKI. And you're utilizing what percent of the current capacity of that pipeline? It's all Canadian gas that's going through it, but as far as capacity?

Mr. PIERCE. Capacity it's less, it's about 40 to 50 percent.

Senator MURKOWSKI. Of it's designed capacity?

Mr. PIERCE. Yes.

Senator MURKOWSKI. Are there clauses in the contract with the Alberta sources that if indeed the market increases that the availability of gas will be increased within the terms of the existing opinion contracts?

Mr. PIERCE. The original contract volume still maintains firm. It will be delivered if those on the other side will receive it. But there is no——

Senator MURKOWSKI. There would be, if they would receive more gas there would be more gas delivered?

Mr. PIERCE. If they would take that which they originally contracted for, that is what would be delivered from Alberta. In effect, they are taking 40 percent of what they originally contracted for.

Senator MURKOWSKI. How would you respond specifically to a layman who might reach the conclusion theoretically by extending a series of short-term contracts for Canadian gas that, in effect, you've achieved a long-term contractual relationship, and as long as Canadian gas is available at a price less than Alaskan gas would have to amortize a significant cost associated with the construction of that additional pipeline, that that very likely would be the logical business conclusion in the best interest of all parties concerned.

Mr. PIERCE. It appears to me that's the same argument as for years we made in relation to the Japanese automobile. It seems to me to be very clear there isn't clear access with the Japanese automobile in American markets just because it's cheaper. I don't think that the U.S. market can be served only by Canadian gas. I think in addition to Canadian gas, Alaskan gas will be required to serve the U.S. market and you may well need something in addition to both of them.

Mr. MACKAY. It's important to note in the long run we expect Canadian gas and Alaskan gas to have to clear the market, and so we don't really expect in the long run any price difference. The comparison that you drew of the $4.40 as the primary first tier Canadian price and $5 are two different timeframes. They're in the same dollars, but the $5 figure for Alaska is 1990, and we do expect some real growth in price between now and 1990.

Senator MURKOWSKI. I'm concerned how you turn this around, and what's going to suddenly turn it around. Obviously, there is an availability of gas at the present time. You have an overabundance of capacity to ship to your market and you can draw down on more gas, and I'm curious to know what's going to change the set of circumstances in the foreseeable future. We all know we're going to run out of energy and we all know as long as we're putting back substantial reserves back into the ground in the North Slope, we're going to have an abundance of gas. But one has to ask himself, if the North Slope gas were coming in today in competition with Canadian gas, and all things being equal, could it be sold in the United States at $5 as opposed to Canadian gas——

Mr. PIERCE. Forty percent of Canadian gas has been sold to the lower 48. I'm saying in the existing marketplace it would depend entirely on the fix of the prices, Sir.

Senator MURKOWSKI. Mr. Jones, would you like to address this area?

Mr. JONES. Yes, I would, Mr. Chairman. I think, first, you have to take an overview of what's going to be happening to our gas supply in this country, notwithstanding the additions to the reserves that we saw in the very late 1970's and 1980, 1981, as a result of accelerated drilling programs, that there is going to be an end to the gas bubble or whatever you want to call it. And we are going to be faced, at least from my point of view and I believe it's shared by many, with the rapidly decline of our gas reserve base and the deliverability of our gas reserves in the lower 48, even though I believe there will be continued drilling for gas and sufficient incentives continuing at reasonable levels. So coupling that with the fact that I am further convinced that the gas industry is going to enjoy reasonably good call for its product in the marketplace, my conviction is perhaps best illustrated by the fact that our company has paid a very full price for Northwest Energy and its two major gas pipelines. Putting these considerations together, I do believe that there's not only a place for Canadian reserves in the U.S. supply picture, but a place for the ANGTS volumes in the U.S. markets in the timeframe that we're talking about. So I do believe there's going to be a continued import of Canadian gas. I think the Canadian markets themselves are going to enjoy growth.

So I think that it's reasonable to assume that No. 1, Canada will not supply all the U.S. needs supplemental to the lower 48 production and No. 2, that the market clearing prices will rise to a point where the kinds of levelized rates we contemplate will permit this gas to move into the market by 1990.

Senator MURKOWSKI. It would seem to me we're in a situation where one could conclude that the economics of marketing higher priced Alaska gas is going to dictate first of all that the prebuild section be up to its capacity of whatever gas is available, or might be available from Canada as dictated by the national energy policy or Alberta or the government of Alberta, whichever has the upper hand, and only then would we anticipate a climate where the Alaska gas might be actually marketed because it's going to have to carry a higher cost so it can be blended in. But I might ask you, Mr. Jones, do you see the deregulation issue currently before the Senate and the Congress of the United States affecting the economics of this project one way or another or is it basically insignificant?

Mr. JONES. I don't believe that the basic issue of deregulation is going to significantly impact this project because by the point in time that we would see the gas in our U.S. market, you're going to have large portions of the market place deregulated, even in the event of no deregulation of the so-called old gas cushioned. All of those matters are going to be brought behind us, and you're going to see gas effectively moving at market clearing prices dictated by alternate fuels.

Senator MURKOWSKI. It seems to me that there's an awful lot of flexibility in the ANGTS project as far as Alaska gas is concerned simply based on the discussion that has taken place at this time. You have a schedule, that schedule has already been advanced, the Canadian supplies have been extended even though they have a great deal more capacity , and we're continuing to put the gas back into the ground. Initially the ANGTS project was believed to have run afoul of the availability of adequate financing, but in reality I suppose one could also conclude that it was the unavailability of the market to accept the gas at a particular time frame that was initially contemplated. Is that a fair evaluation of the reason it hasn't gone today?

Mr. JONES. Of course I wasn't part of the action during the time there was an effort being made to finance the project. I think that probably uncertainties that were faced with respect to major energy supplies and energy pricing at a particular point in time had an impact on it as well as some of the other points of view of the various actors, including most importantly perhaps the lenders.

Because as we move forward in this effort, and again I go back to my written testimony and my oral statement, the financial community has been through a lot recently with respect to the energy sector and to some of the loans that have been made through that sector. I think they're going to continue to be very very cautious with respect to commitments, especially of this magnitude. And I would reiterate my point of view that there's going to have to be absolute commitment of reserves and the associated firm commitments that are going to let us access the money to finance the project.

Senator MURKOWSKI. Statements have been made previously to this committee by the spokesmen from Northwest Energy with regard to the request of consideration for Federal assistance in this project, and to my recollection at least, there was an emphatic denial of any consideration initially for Federal funding. In your position representing the acquisition of the assets and liabilities of Northwest as spokesman for Williams, have you ruled out or would you consider or are you considering pursuing this project with any consideration of Federal assistance of any kind in the form of funding?

Mr. JONES. Having been on board for about 40 days, we've reached no real conclusion. However, at this point in time I would see no reason to abandon the position that Northwest management previously had taken. However, if any conditions were changed beyond those that we now perceive, certainly that could have an impact on my point of view.

Senator MURKOWSKI. Have you had a chance to examine the congressional endorsement of the Northwest project in the sense of whether or not you feel it would preclude any other use of North Slope gas?

Mr. JONES. I'm not a lawyer so I'm operating on the advice of lawyers, as well as those who have been long involved in the process. Based on the descriptions of those commitments and summaries that I have looked at and discussions with people who have been long involved, including attorneys, it is my view that those commitments are firm.

Senator MURKOWSKI. And binding.

Mr. JONES. And binding. I believe they are further bound by commitments that have been made on the part of the sponsoring interests to pursue the project.

Senator MURKOWSKI. Do you think there is any question of a reasonable time frame associated with those commitments?

Mr. JONES. A reasonable time frame?

Senator MURKOWSKI. What would be unreasonable as to how long those commitments should stand?

Mr. JONES. Ten years or something like that, at I see it at this point in time. That point of view being subject to change.

Senator MURKOWSKI. That's open for reconsideration.

Mr. JONES. Sure.

Senator MURKOWSKI. But there is obviously some point in time at which——

Mr. JONES. At least 10 years from now.

Senator MURKOWSKI. There has been a contention that the franchise which your companies acquire is really a franchise for distribution in the continental United States as opposed to any other use of the gas. As a consequence there is a distinction.

Mr. JONES. We believe the franchise is for use in the continental United States, with gas flowing through the system that has been defined as the ANGTS and utilizing the prebuilt facilities.

Senator MURKOWSKI. My question is, if it's used for some other purpose, is it precluded under the franchise that you have which is a specific use as opposed to some other use, I assume your contention would be obvious?

Mr. JONES. Yes.

Senator MURKOWSKI. You indicated in your opening remarks that you had expended about $3.1 billion collectively.

Mr. JONES. The total.

Senator MURKOWSKI. And that I assume has been primarily a commitment to the prebuild which is operational plus any preliminary engineering for the Alaska portion. Can you provide a rough estimate of how much more would be required prior to initiation of an actual construction contract for the Alaska section of the pipeline? We've heard from Mr. Rhett and he indicated that he's operating on reduced budget, but it's a continuing nature which indicates the Federal commitment to the pursuance of this project. And you've indicated you expended $3.1 billion and you've got an operation, prebuild function from Alberta, but the question is how much more is needed before you enter into a construction contract?

Mr. JONES. I really haven't looked at that particular issue at this point definitively. We have a study underway, are you talking about the figure that would include all of the final definitive engineering that would get us to the point say where we would let the contract?

Senator MURKOWSKI. That's correct.

Mr. JONES. We don't have that figure because I don't know what it takes to get through the mile by mile design, and we're still studying some of the alternatives with respect to the pipeline design itself, which very well warrant the time and the money it's going to take. So I really can't answer that question. I don't know what it takes to do the mile by mile.

Senator MURKOWSKI. I'd very much appreciate, the record will be open for a period of 30 days, if you could supply just your rough estimate.[1]

My second question is, recognizing the commitment that Northwest had prior to its being acquired by Williams, a very aggressive posture pursuing the project, I'm wondering what commitments Williams has to proceed, because I would assume this is work that has to be done regardless of when it happens, its preliminary engineering soil studies.

Mr. JONES. Of course the commitment to do the studies and data gathering is proceeding with the test sites in Alaska. It's proceeding forward.

Senator MURKOWSKI. Do you have any idea for the record what the anticipated expenditure is for this current year and next year?

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[1] The response to this question appears in Mr. Jones' responses to the subcommittee questions in app. I.

Mr. JONES. For that particular work for next year, it's probably going to be about $5 million.

Senator MURKOWSKI. For 1984?

Mr. JONES. For 1984. Exclusive of any special work that would be done with respect to the details, any detailed engineering. But the completion of that will be about $5 million.

Mr. MACKAY. It might be helpful to clarify. A tremendous amount of work has been done in terms of what one would normally think about as design engineering work for such a pipeline project. For the test work that Mr. Jones alluded to, particularly in relation to the frost heave matter, we've already spent something over $100 million to resolve that issue. The work that is now being completed, that the Federal inspector will be in the process of approving, is of such magnitude that it will then permit us to just essentially complete the detail design. All of the criteria by which the design mode will be selected, for every type of soil condition that is contemplated, will be done and will be approved during this preconstruction period.

Senator MURKOWSKI. Is there a timeframe for this to actually occur? I know it's been ongoing.

Mr. MACKAY. The completion of this initial work to establish design criteria will occur next year.

Senator MURKOWSKI. And then at next year's point you theoretically at least would be in a position to consider letting a contract if economic conditions indeed——

Mr. MACKAY. There would still be some engineering work, but that's all contemplated in the overall schedule that has been described in Mr. Jones' testimony.

Senator MURKOWSKI. I assume from Mr. Jones' remarks that Williams Corp. intends to go ahead with the basic schedule that had been outlined by Northwest to proceed with the project?

Mr. JONES. That's correct. My perception is that a very logical plan has been put together by Northwest and the other sponsors.

Senator MURKOWSKI. Mr. Jones, in your testimony you referred to a need to have all of the reserves, all of the gas and obviously you design a pipeline to a capacity and you can achieve that capacity, while obviously you're in more of a position than Mr. Pierce is, who has the design capacity but doesn't have the market. At what point in time would you say that there was more gas there than you could, than your capacity dictated, that you could handle and as a consequence you would have a surplus? What I'm getting at is an obvious question, how much is reasonable and when might that occur?

Mr. JONES. The amount of gas has been defined in proven reserves, is that which would appear to be the minimum required to support a project, the ANGTS project. If there were in fact additional reserves discovered in the North Slope, I think to the extent that the market were going to accept those reserves they would of course reduce the cost associated with the pipeline by both extending its life and providing for inputs in the line. At some point in time, if the reserves were four times what they are today, there could very well be a situation where the ANGTS project will not be able to handle those reserves, so I don't want to appear too greedy.

Senator MURKOWSKI. You're in the gas business. Being in the gas business, have you looked at or examined or do you have any comment on your assessment of the market with the Pacific Rim countries for Alaska gas at this time?

Mr. JONES. My personal perception is it's going to be very difficult to sell that gas in the Pacific Rim market, particularly the Japanese market and also the Korean market, against their alternative supplies and in light of the commitments that they've already made for gas supplies in the Pacific Rim, particularly the Japanese. I have had some experience in dealing with Japanese interests, not as it relates to gas at this point in time, but with other energy forms, particularly coal, and have found that they certainly do a very good job of examining their alternatives. But because of their desire to preserve certain aspects of their existing energy utilization base, particularly their oil-fired generating capacity, they're very slow to make those additional commitments.

I think it's going to take a lot of work and a long time to get to that point.

Senator MURKOWSKI. Do you think as a consequence of the recent joint communique on energy as well as addressing coal and oil highlighted the feasibility study of gas is indicative of a growing concern of the deficit balance of payments somewhere in the area of $22 billion, and a method to counter that by suggesting to Japan that they consider buying some long-term gas from the United States? Recognizing it isn't the cheapest gas available to Japan, but to do something meaningful about that deficit as compared to some of the other things we talk about, again, beef and oranges.

Mr. JONES. Certainly I think all of us should have a deep interest in seeing our deficits reduced in this country. Personally I would like to see a great deal of emphasis given to the opportunity to put U.S. coal into those Japanese markets. I continue to believe there are probably alternatives available in the Japanese interest that would lead them to use other means to change that deficit before they would turn to natural gas. I would also point out the one way we can reduce our own great deficit would be to permit the greater use or encourage the greater use of natural gas in this country and reduce our reliance on imported crude oil; this would be desirable from the standpoint of reducing our great deficit and also from the standpoint of national security.

Senator MURKOWSKI. So you're in favor of exporting little Alaskan oil?

Mr. JONES. Well that's an issue I'd better leave to my producer associates.

Senator MURKOWSKI. I couldn't resist that. You brought it up.

Recognizing that some people appear well recognizing you are in the gas business, sir, and follow the projections associated with the economics and the upswings and downswings of the market and with that in mind, what is your best estimate of when the economic conditions will be such as to favor the pursuance of the ANGTS project as proposed?

Mr. JONES. My best estimate which would also be probably a guess, is that given 5-years' construction time that a 1990 or 1991 startup date is not unreasonable.

Senator MURKOWSKI. You anticipate from that conclusion the construction would start in what year?

Mr. JONES. Start in 1985, 1986.

Senator MURKOWSKI. And I assume that at least at this stage that's your corporate target?

Mr. JONES. The corporate target would be to start as soon as possible, but that seems like a reasonable estimate at this point.

Senator MURKOWSKI. Congress recently granted, well not recently but a year or so ago, the waiver pursuant to ANGTS in order to expedite construction financing of the project. There was no expiration date set on that because at that time Congress really saw no delay of the project. In light of the delay that we have seen, the questions coming up again, should Congress revisit this matter in view of the delay? And I assume your position is you don't think it's relevant for Congress to go back into that, and your comment on what's reasonable and unreasonable as 10 years or thereabouts.

Mr. JONES. You're correct. I would have the same answer to that.

Senator MURKOWSKI. I don't want to put words in your mouth.

Mr. JONES. That's quite all right. I try to be consistent in my point of view.

Senator MURKOWSKI. You're extremely consistent.

I think I've basically concluded my questioning. I do think it's of extreme significance to hear from Mr. Jones and Mr. Pierce in an update on the project and the dedication of the principles to see this project to its conclusion, and I would wish you well and hope that Congress does not stand in your way unreasonably. And obviously the realities of the market conditions are something that I guess as you said, Mr. Jones, you can only guess, but you guess with a high degree of expertise and for that we're thankful.

I would excuse you as witnesses, and again express my thanks and appreciation for your expert testimony.

As we're awaiting the next panel, panel four, I would like to indicate for the record that we have a statement for the Canadian Government.

[The statement of the Canadian Government follows:]

Canadian Embassy Ambassade du Canada

Note No. 591

The Embassy of Canada presents its compliments to the Department of State and has the honour to refer to the hearings in the U.S. Senate on alternatives for natural gas development in Alaska, scheduled for November 16, 1983. The Embassy would be grateful if the Department could ensure that the views of the Canadian Government on the Alaska Natural Gas Transportation System (ANGTS), including the southern segments of the system which have already been completed, are made known to the Senate hearing.

Canadian Government views are incorporated in the ... attached brief on Canada's involvement in the ANGTS. The Embassy wishes to draw attention in particular to the following points:

- The decision of the Government of Canada to facilitate construction of the ANGTS was taken in the firm conviction that the earliest possible transport of U.S. natural gas from the western Arctic to southern markets would make a vital contribution to reducing U.S. and Canadian dependence on insecure world oil supplies and depleting gas reserves in conventional areas of the two countries;

.../2

- Selection of the ANGTS followed three years of careful consideration of several competing proposals by Canadian and U.S. regulatory authorities and intensive negotiations between the governments of both countries;

- Joint action by the Canadian and U.S. Governments on the ANGTS was preceded by conclusion of the Transit Pipeline Treaty, which provides for non-discriminatory treatment of pipelines in one country used to transport the hydrocarbon products of the other and non-interference with supplies of hydrocarbons crossing one country en route to the other;

- The broad commitment of the two governments to facilitate completion of the ANGTS found expression in the Agreement on Principles Applicable to a Northern Natural Gas Pipeline. The Agreement declared that the two governments would "take measures necessary to facilitate the expeditious and efficient construction of the Pipeline", including the prompt issuance of all required regulatory approvals;

- The Agreement expressed the understanding of both governments that the pipeline would be privately financed and made provision, among other things, for determination of the pipeline's route and capacity, for close cooperation and consultation between the appropriate regulatory agencies of both countries, and for the procurement of goods and services related to construction of the pipeline on generally competitive terms;

- In the spirit of the understanding of that Agreement and at the urging of the U.S. Government, the Government of Canada made the difficult decision to authorize commencement in 1980 of construction of the southern segments of the pipeline in Canada;

- The decision by the Government of Canada to authorize pre-building of the southern segments of the pipeline for the initial purpose of transporting Canadian gas to U.S. markets was made on the mutual understanding

.../3

that the entire system would be completed expeditiously in order to allow for the timely flow of Alaskan gas. This was based on assurances at the time of the U.S. Administration and Congress;

- Construction of the Western Leg and the Eastern Leg of the southern portions of the pipeline has been completed. Financing for the construction was based on the short-term export of Canadian gas;
- Clearly, the Government of Canada would not have chosen on its own initiative to authorize the construction of large and expensive new facilities solely for the purpose of exporting a relatively small volume of surplus Canadian gas for a limited period to U.S. markets;
- Any lessening of the resolve by the governments or the regulatory authorities in the two countries to facilitate the completion of the project on a timely basis could undermine the financial basis of those sections of the pipeline already completed, to the detriment of both Canadian pipeline companies and natural gas producers.

The Embassy of Canada avails itself of this opportunity to renew to the Department of State the assurances of its highest consideration.

Washington, D.C.
November 15, 1983.

BRIEF ON
CANADA'S INVOLVEMENT
IN THE
ALASKA NATURAL GAS TRANSPORTATION SYSTEM

The Road to Agreement

Over a three-year period between 1974 and 1977, a variety of proposals for transporting United States and/or Canadian natural gas in the Western Arctic to southern markets were considered by both U.S. and Canadian regulatory agencies. The U.S. Federal Power Commission (FPC) decided in favour of an all land route, rejecting an alternative that would have involved the transport of Alaskan gas to market in the form of LNG. The FPC, however, did not decide between two competing all overland proposals. Canada's National Energy Board recommended approval of the Alaska Highway Pipeline Project. This subsequently became the focus of consideration by the governments of the two countries. An agreement providing for the joint undertaking of the project was subsequently signed following a brief but intensive period of negotiations on September 20, 1977. These negotiations were facilitated by the earlier agreement reached between Canada and the United States on the Transit Pipeline Treaty, which provided for the non-discriminatory treatment of systems in one country used to transport the hydrocarbon products of the other.

The Canada-United States Agreement, which covered a wide number of aspects relating to the construction of the 5,500-mile system for the transportation to southern markets of up to 2.4 billion cubic feet daily of U.S. gas from Alaska and up to 1.2 billion cubic feet a day of Canadian gas from the Mackenzie Delta, was submitted to the Congress for approval by President Carter on September 22, 1977, and enacted on November 8. In Canada, legislation proposing adoption by Parliament of a Northern Pipeline Act was introduced in February the following year and came into force on April 13, 1978. The Act gave effect to the Agreement between the two countries and established the Northern Pipeline Agency to oversee the planning and construction of the project in Canada.

Delays

While the Canada-United States Agreement envisaged that the entire project would be completed and ready to go into operation by January 1, 1983, the target date has been progressively set back to the current schedule of 1989 for several reasons. These included: the prolonged debate in Congress over legislation to establish a new natural gas pricing regime - the nature of which was critical to the Alaska Highway Project, the lengthy period required to resolve major outstanding regulatory questions, the

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initially slow progress of the Alaska Pipeline sponsor and Prudhoe Bay producers in reaching agreement on questions related to final design/engineering and financing of the Alaskan system, and the further period required for the consideration by the Administration and Congress of the waivers to U.S. legislation governing the project. The world-wide recession and soft gas markets in the lower 48 states have also exacerbated the difficulties faced in financing such a massive project.

First-State Construction

A proposal for pre-building of the Western and Eastern Legs of the system in southern Canada and the continental United States for the initial purpose of transporting surplus Alberta gas to U.S. markets was first recommended by the National Energy Board of Canada but subsequently strongly endorsed in principle by the United States. The proposal will have the effect of reducing the tariff for the transport of Alaskan gas when it begins to flow.

Findings by the National Energy Board at the end of 1979 and beginning of 1980 of a sufficient short-term surplus of Alberta gas made first-stage construction financially feasible if the timely arrival of Alaska gas was assured. Such an approach also received the strong endorsement of the U.S. Administration. However, without the arrival of Alaska gas the depreciation rates included in the tariff and borne by the Canadian producer are abnormally high. To date such high charges in Canada have been avoided but cannot be avoided indefinitely.

However, the Government of Canada could not have authorized the construction of expensive new facilities for the short-term export of gas unless it was certain of the resolve of the United States to carry out the Agreement on Principles. Therefore, the Canadian Government sought assurances from the United States in the early summer of 1980 that the whole project would proceed expeditiously. The decision of the Government of Canada in July to approve the undertaking of this first stage was based on three main developments: (1) the agreement previously reached between the pipeline sponsor and producers on sharing the costs of completing final design and engineering of the system in Alaska and on working together to evolve a financing plan; (2) the high priority accorded to the project by Congress in a joint resolution unanimously approved by both the Senate and the

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House of Representatives; and (3) a letter from President Carter on behalf of the United States Government strongly supporting the project and expressing confidence that it would move ahead on a timely basis.

At the time of the decision and subsequently the Prime Minister and other spokesmen for the Canadian Government have expressed their confidence that the United States Government and Congress would take the necessary action to expedite the completion of the project. Consequently, in meetings between Canada and the United States since the prebuild decision, including meetings between the President and the Prime Minister, and most recently between the Canadian Minister of External Affairs and the Secretary of State in October, 1983, Canadian representatives reiterated that the Canadian decision was based on the assurances received from the U.S. Government and the general support of both Houses of the Congress.

First-phase construction of the Western Leg was completed in the fall of 1981 and Canadian gas began flowing through the system on October 1, 1981. Construction of the Eastern Leg was completed in the summer of 1982 and gas began to flow in September of that year.

Regulatory Consultations

In keeping with both provisions and spirit of the bilateral agreement, there have been extensive consultation and discussion between the appropriate Canadian and U.S. regulatory agencies with respect to a number of project-related issues of concern to the two countries.

The National Energy Board of Canada and the Federal Energy Regulatory Commission of the United States have discussed at length such issues as the tariff to cover transportation of gas through the Alaska Highway Gas Pipeline System - with particular concern for the question of just and reasonable tolls, the incentive rate of return scheme with respect to equity investment, and the establishment of a date for commencement of the mainline tariff.

Canada's Northern Pipeline Agency and the U.S. Office of the Federal Inspector, which share many similar responsibilities for ensuring that the planning and construction of the project within their jurisdictions is undertaken in accord with the terms and conditions established under the respective laws of the two countries, have also maintained close liaison. In particular, the

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two agencies have worked closely together in implementing the reciprocal arrangements for exchanging information on the procurement in both countries of certain designated items for the project in accordance with the Canada-United States Agreement and the procedures established through an exchange of notes between the governments of the two countries in June, 1980.

The Canadian Government has requested and the United States has agreed to consultations under the Agreement on Principles to discuss certain tariff problems which have arisen on the pre-build section. Continued delays in the arrival of Alaska gas have led to tariff and depreciation problems on the pre-build which are having an adverse impact on both the U.S. consumer and Canadian producer.

Continued Efforts to Complete the Northern Section of the Pipeline

Despite the set-backs experienced in attempts to finance the pipeline in the spring of 1982 that led to a further announced delay in completion to 1989, the pipeline companies and the North Slope producers have continued their efforts to overcome the outstanding problems. It is the Canadian Government's understanding that considerable progress has been made. It is likely that this work will lead to substantial cost estimate reductions for the natural gas conditioning plant to be located on the North Slope. Further savings may be expected with the pipeline itself. Work also continues on technical problems, attempts to reduce the high transportation costs, and marketability problems.

In Canada, because of the nature of the terrain, most technical problems have been overcome. The Canadian pipeline companies continue to cooperate closely with their U.S. counterparts on financing problems.

In conclusion, the Canadian Government remains committed to the Principles set out in the Agreement between the two countries. It continues to believe that for the national security of both countries, access to northern reserves of natural gas will be required. Consequently, the Canadian Government looks forward to continued cooperation with the United States under the Agreement to bring about its implementation.

Senator **Murkowski**. I would welcome the next panel. We have Hon. Walter Hickel, chairman of Yukon Pacific Corp.; Mr. O. Pendleton Thomas, Mr. Leigh Cox, and Mr. Peter Flannigan.

We welcome you gentlemen to the committee. I see that you have some charts before us; and we look forward to your testimony. This is the first time that you have been blessed as a form of incorporation with the opportunity to appear at the congressional hearing, and that we hope that we maintain an open mind in your point of view; and that you don't have to come here too often because that's a long way to come.

Please proceed. I would ask whoever is the spokesman to proceed with the testimony.

STATEMENT OF HON. WALTER J. HICKEL, CHAIRMAN, YUKON PACIFIC CORP.

Mr. **Hickel**. Thank you, Mr. Chairman. I'm Walter J. Hickel, chairman of Yukon Pacific. I appreciate the opportunity to be here.

As was mentioned 15 years ago Alaska's largest—America's largest concentration of natural gas was discovered on the North Slope.

The importance of moving this gas to market has never been questioned.

Seven years ago, Congress passed the Alaska Natural Gas Transportation Act, ANGTA, which set in motion a decision to move that gas to the Midwestern part of the United States.

Mr. Chairman, no one here today is suggesting that ANGTS be abandoned. We are here to ask how long that gas should be restricted to only one option.

Yukon Pacific Corp. doesn't own any gas. We don't own any markets. What we're trying to do is to bring governments, producers, and new markets together in an attempt to get this gas going.

Let me explain. ANGTS itself was not created by the free market. It is a product of the regulatory decision by government, not only on its route, but on its cost to the consumer. In the case of ANGTS higher costs were justified on the basis of a perceived need for natural gas at any reasonable costs.

In the Alaska Natural Gas Transportation Act, for instance, Congress found that "a natural gas supply shortage exists in the contiguous states of the United States."

Today, many people will focus their testimony on the need for this gas. I am sure you can find experts on both sides, given the current gas glut.

As a matter of fact, I could stand here and quote American Gas Association President George Lawrence who recently said there's a general feeling that the natural gas supply problem is a thing of the past "in the short, the medium, or the long term." Supply, he told Oilgram News "is not just a factor of demand."

Because even if we say we need that gas, we have to ask the question, can we deliver it.

Unless the Federal Government decides to back up its findings with money, a Government finding doesn't make that much difference.

The real test is whether the project can be financed.

Even regulated projects must stand one test in the free market. And that is in the free market for money.

If a gas pipeline is certified and contracts are signed, and the tariff is far beyond that of the competitive market price anyway, most bankers won't buy it.

When Yukon Pacific attempts to build a pipeline to serve the international market, we start with a different set of assumptions.

We know from the start that our price has to be competitive.

There can be no illusions that financing will occur with the regulated price far beyond the market.

In ANGTS, the regulated project to move North Slope gas to market, the Government devised an incentive rate of return, an allowable return which varied with costs, to replace the mechanism of the market in controlling costs.

For our project, when we line up to sell gas to Japan, Korea, or Taiwan, our regulator is the price our competitors have to offer. If we can't beat the proposal that Indonesia, Canada, Australia, Malaysia, Thailand, the Soviet Union, or Abu Dhabi lay on the table—we simply don't have a project.

We know these things. We're willing to take the risk. And we want to urge upon you the same philosophy.

Mr. Chairman, I think we're at the point where all the expert advice Government has at its disposal won't solve the problem. Because when it comes to action, Government has three kinds of tools it can use to help get this gas to market.

You can restrict. You can promote. And you can spend.

Right now, you've restricted the gas to one market. It may work, but it hasn't yet.

You can promote. You've done that, both here in the United States, and in international discussions the President has held in Canada, Japan, and Korea. I urge you to continue that.

You can spend. I don't think you want to do that. Nor should you.

So really, Mr. Chairman, you have two choices.

You can do nothing—continue to restrict—and hope that Northwest will complete the pipeline across Canada someday.

Or, without prejudice to Northwest, you can remove the perceived exclusivity ANGTS enjoys, and commit the United States to market its gas wherever it can be sold

Thus, you promote both projects.

The so-called Y-line proposal made by Yukon Pacific gives America an option. Mr. Thomas and others will show how it can serve both conceivable markets, when each market is read.

The Y-line is also an offer to cooperate with ANGTS. Let me tell you why I think TAGS——

Senator MURKOWSKI. Would you please——

Mr. HICKEL. Trans-Alaska Gas System.

Senator MURKOWSKI. Thank you.

Mr. HICKEL. In strict legal terms, I do not believe the law restricts the North Slope producers and the State of Alaska from selling their gas anywhere in the world, including the Pacific rim.

Yukon Pacific has begun to apply for the permits necessary to construct a pipeline across Alaska.

Our intended market is the Orient, Japan, Korea, and Taiwan.

But, Mr. Chairman, even if the law says you can do it, it is hard to sneak an 820 mile pipeline across Alaska in the dark of the night.

We believe Congress, which sets policy in this country, should take a neutral stand with regard to which pipeline gets this gas to market.

The legislation we seek is simple. First, we do not need to change ANGTA as much as clearly state that it does not bestow an exclusive franchise to ship North Slope gas. Second, legislation similar to that enjoyed both by the Trans-Alaska Oil Pipeline System and ANGTS to expedite permitting and remove the threat of long-term litigation would help TAGS as well.

We're not suggesting a drastic change in national policy.

Let me show you how what we're proposing is consistent with America's other goals.

In energy policy, our goal has been production. There is a consensus in America, Mr. Chairman, that where enviornmental concerns are ironed out, energy production should go on.

In Alaska, we're never going to produce our potential oil reserves without shipping our gas.

There seems to be something inherently wrong when major energy companies turn away tracts with high oil potentials on the North Slope, simply because they have high gas potential too.

Let's do everything we can to get that gas to market.

It will help us produce more oil.

In trade policy, our goal has been to balance our trade with our trading partners.

Somehow the idea that we help ourselves and hurt Japan by refusing to sell them energy has turned things upside down.

We certainly don't help ourselves with a balance of trade that was in Japan's favor last year by $18 billion.

We have to sell Japan what it needs. We can't sell them harnesses if they don't have horses. What they need is energy.

Mr. Chairman, experts on both sides of the Pacific agree that the best way to balance our trade with Japan is by trading energy.

It is a way to expand the opportunities of both countries.

I believe that is what America looks for when it trades around the world.

Another national policy goal has been strengthening our ties with Pacific nations, and boosting our national security.

To me, Mr. Chairman, national security is gained through exchange and common interests.

Countries that trade together stay together.

When we told Japan ten years ago that we weren't going to sell them energy, they didn't stop. They went to other nations.

Australia, Canada, Malaysia, Indonesia, Abu Dhabi, Thailand, and even the Soviet Union have moved to fill the bill for natural gas.

Alaska pioneered the market for LNG in Japan in 1969. We started working on the project in 1961. We had 100 percent of the market share. We shipped 1 million tons to Japan per year then, and we still ship 1 million tons. Today we ship 1 million tons out of 18 million tons. In 1990 we'll have 1 million tons out of 37 million tons.

Where is the Yankee trader? No wonder our trade is out of balance.

Our market share is reduced to less than 3 percent. We can compete in Japan. It is not that we couldn't, we wouldn't.

In conclusion, Mr. Chairman, all we're asking for is the right to compete again. We want our government supporting us as we attempt to make the trade. Our competition has it. We shouldn't deny it to ourselves.

The Alaska natural gas, we have nothing to fear but freedom.

Senator MURKOWSKI. Thank you for a very good statement.

[The prepared statement of Mr. Hickel follows:]

TESTIMONY OF THE HONORABLE WALTER J. HICKEL
BEFORE THE ENERGY REGULATIONS SUBCOMMITTEE
OF THE ENERGY AND NATURAL RESOURCES COMMITTEE
OF THE UNITED STATES SENATE

November 16, 1983

Mr. Chairman, Members of the Committee, I am Walter J. Hickel, Chairman of Yukon Pacific Corporation.

Thank you for the opportunity to be here today.

Our purpose here is not to rewrite history but to fulfill history's promises. We still have to make something happen.

I speak of one of America's largest concentrations of natural gas, discovered fifteen years ago with the oil on Alaska's North Slope.

The importance of moving this gas to market has never been questioned.

Seven years ago, Congress passed the Alaska Natural Gas Transportation Act, A.N.G.T.A., which set in motion a decision to move that gas to the midwestern part of the United States.

A consortium of investors spent hundreds of millions of dollars to design and engineer the project and to get the necessary permits.

The federal government has taken extraordinary action as well. It has expressed its commitment through international agreements, creation of the Office of the Federal Inspector, allowance of rolled-in pricing, and Congressional passage of waivers of law in 1981.

Despite this effort, one fact remains. In the next 24 hours, more than two billion cubic feet of natural gas will be reinjected into the ground at Prudhoe Bay. It should be serving mankind.

Mr. Chairman, no one here today is suggesting that A.N.G.T.S. be abandoned. We're here to ask how long that gas should be restricted to only one option.

Yukon Pacific Corporation doesn't own any gas. We don't own any markets. What we're trying to do is bring governments, producers, and new markets together in an attempt to get this gas going to market.

And we believe Congress should encourage an alternative project to proceed where another group of investors, the State of Alaska, and other owners of the gas are willing to try.

This time, Mr. Chairman, we're asking for the right to try in the free market.

Let me explain.

After working on deregulation for the past few months, the members of your Committee know all too well that we do not have a free market for natural gas in this country.

Our nation's utilities, as monopolies, are regulated. Before they are built, major pipelines are scrutinized in competitive hearings for their economic viability and their utility to the nation. After construction, these pipelines are regulated as to what they can charge.

In most cases, this tariff regulation is used to protect the consumer from monopoly pricing by the pipeline owners.

A.N.G.T.S. itself was not created by the free market. It is a product of a regulatory decision by government, not only on its route, but on its costs to the consumer.

From the start, it was known that in the early years of service for any Alaska North Slope gas project, delivering gas to the United States would only be accomplished if consumers paid more than the prevailing market price. 1/

Regulators overseeing A.N.G.T.S. were charged by President Carter with trying to prevent cost overruns and to keep costs down. In the end, however, these regulators also had the power to insist that consumers of North Slope gas bear higher costs. 2/

In the case of A.N.G.T.S., higher costs were justified on the basis of a perceived need for natural gas at any reasonable cost.

1/ Under the provisions of the Natural Gas Policy Act of 1978 (NGPA), signed into law November 9, 1978, rolled-in pricing treatment for Prudhoe Bay gas is provided for, allowing the price of this gas to be averaged in with lower cost price-controlled gas in the Lower 48.

2/ Pursuant to the mandate of the President's Decision to devise a variable rate of return mechanism, the FERC on May 8, 1978 commenced a rulemaking which culminated in the issuance of its Orders 31 and 31-B on June 8 and September 6, 1979. These orders established an incentive rate of return (IROR) mechanism applicable to the Alaskan Northwest and Northern Border segments governing the rate of return that the ANGTS sponsors of those segments may earn on equity invested.

In the Alaska Natural Gas Transportation Act, for instance, Congress found that "a natural gas supply shortage exists in the contiguous states of the United States."

A report of this Committee on the so-called "waiver package" was submitted to the full Senate exactly two years ago today. It asked the question: "Do we need the Alaskan gas?" and answered, after looking at the hearing record, "Yes."

Today, many people will focus their testimony on the need for this gas. I am sure we can find experts on both sides, given the current gas glut.

As a matter of fact, I could stand here and quote American Gas Association President George Lawrence who recently said there's a general feeling that the natural gas supply problem is a thing of the past "in the short, the medium, or the long term." Supply, he told Oilgram News "is now just a factor of demand." 3/

Mr. Lawrence's statement could be seen as helpful to our cause. But that's no longer the point. We don't think it's important--or even proper or possible--for this Committee or this

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3/ Platt's Oilgram News, Wednesday, October 26, 1983.

government to decide whether the United States needs the gas. Because even if we say we need it, we can't deliver it.

Unless the federal government decides to back up its finding with money, a government finding doesn't make much difference.

The real test is whether the project can be financed.

Even regulated projects must stand one test in the free market. That is the free market for money.

If a gas pipeline is certificated, and contracts are signed, and the tariff is far beyond that of the competitive market price anyway, most bankers won't buy it.

That's true because the banker knows that the foundation of regulation can fall away tomorrow, but the money he's lent will still have to be repaid from a tariff higher than the market price.

Mr. Chairman, that's one reason why you've seen representatives of banking institutions appear before your Committee recently to speak against deregulation of natural gas in the lower 48. 4/

4/ It must be observed from the current debates over gas deregulation, and the cost of gas imported into the United States, that the banking community is growing more concerned about the ability of governments to authorize projects where economic feasibility depends upon enforced, certificated prices that are higher than prevailing markets. See the Wall Street Journal, Tuesday, November 1, 1983, "Reagan's Gas Decontrol Bill is Meeting Opposition by Some Big Banks, Insurers":

> As the Senate prepares to debate gas decontrol this week, representatives of the country's major life insurance companies, along with Chase Manhattan Bank and some other lenders, have begun a powerful lobbying effort against provisions in the bill that would cancel many existing contracts and require them to be renegotiated by the late 1980's . . .
>
> Insurance companies and banks frequently relied on the anticipated long-term revenue from such contracts when they lent money to dig gas wells or build pipelines. If the decontrol bill is approved by the Senate, many lenders are concerned the primary source of revenue to repay the loans could be jeopardized.

See also: Inside Energy/Federal Lands, November 7, 1983, "Banks warn ERA against curbing gas import, say future projects at stake":

> Members of the financial community have warned the Economic Regulatory Administration that suspension or termination of Trunkline LNG's authority to import Algerian liquefied natural gas would jeopardize financing of future energy projects. Two banks and a brokerage house all told ERA that confidence in government authorizations, such as that extended to Trunkline LNG several years ago, is essential to securing financing.
>
> But such concerns of the financial community were discounted by two members of Congress who have long sought to stem the Algerian LNG imports. Reps. Tom Corcoran, R-Ill., and Dan Coats, R-Ind., wrote ERA: "The extent to which suspension or termination of this project would have an adverse effect on the

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When Yukon Pacific attempts to build a pipeline to serve the international market, we start with a different set of assumptions.

We know from the start that our price has to be competitive.

There can be no illusion that financing will occur with a regulated price far beyond the market.

In A.N.G.T.S., the regulated project to move North Slope gas to market, the government devised an incentive rate of return, an

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> financing of other useful gas-import projects depends upon the treatment of those who have invested in this project. A certificate from the federal government does not entitle any investor to a guaranteed rate of return. If such a guarantee is necessary to secure the financing of a gas-import project, that project is not likely to be in the public interest." Corcoran and Coats, whose districts are recipients of the relatively high-cost Algerian LNG, want ERA to suspend the imports "at once." But they add that Panhandle Eastern Pipe Line, the parent company of Trunkline LNG, and Lachmar, the firm that ships the LNG, should be allowed to recover "legitimate costs."
>
> Authorizations seen most important in project financing. Canadian Imperial Bank of Commerce, the other bank responding to ERA, said "heavy reliance" has traditionally been placed on government authorizations. "The terms upon which our bank and other lending institutions have been prepared to make loans for these purposes have been materially influenced by the regulatory environment," wrote Douglas Roberts, a vice president of the Toronto bank. "In the case of project

allowable return which varied with costs, to replace the mechanism of the market in controlling costs.

For our project, when we line up to sell gas to Japan, Korea, or Taiwan, our regulator is the price our competitors have to offer. If we can't beat the proposal that Indonesia, Canada, Australia, Malaysia, Thailand, the Soviet Union, or Abu Dhabi lay on the table--we simply don't have a project.

We know these things. We're willing to take the risk.

We want to urge upon you the same philosophy.

Mr. Chairman, I think we're at the point where all the expert advice government has at its disposal won't solve the problem. Because when it comes to action, government has three kinds of tools it can use to help get this gas to market.

You can restrict. You can promote. You can spend.

4/ (continued)

financing, concerns about the regulatory environment have been even more significant, as regulatory authorizations frequently provide the primary security-support mechanism for the financing." Morgan Stanley & Co. expressed views similar to those of Chase and Canadian Imperial.

Right now, you've restricted the gas to one market. It may work, but it hasn't yet.

You can promote. You've done that, both here in the United States, and in international discussions the President has held in Canada, Japan and Korea. I urge you to continue that.

You can spend. I don't think you want to do that. Nor should you.

So really, Mr. Chairman, you have two choices.

You can do nothing--continue to restrict--and hope that Northwest will complete the pipeline across Canada someday.

Or, without prejudice to Northwest, you can remove the perceived exclusivity A.N.G.T.S. enjoys, and commit the United States to market its gas wherever it can be sold.

Thus you promote both projects.

Hold both our feet to the fire. Encourage A.N.G.T.S. and T.A.G.S. to produce.

The so-called Y-line proposal made by Yukon Pacific gives America an option. Mr. Thomas and others will show how it can serve both conceivable markets, when each market is ready.

The Y-line is also an offer to cooperate with A.N.G.T.S. Let me tell you why I think T.A.G.S. will work--why we've trying and why we think our government should try with us.

I've lived in Alaska for forty-three years. For almost all of my adult life I've been trying to make Alaska's opportunities happen.

After the Second World War, we all worked to get a timber industry going. We had to look at our natural markets.

We knew they weren't with our closest neighbors on this continent, Canada and the Pacific Northwest.

They already had plenty of trees to sell themselves. We couldn't give them away. We had to look to Asia.

Our fishing industry also has grown since the war.

Try as we might, we couldn't get America interested in the vast protein resources of Alaska.

Japan, as much as any other nation, is responsible for developing our fishing industry.

Alaska always has been known for its vast resources of coal.

We couldn't ever compete with Wyoming in shipping our coal to America. We either use it ourselves, or ship it to our natural markets, Japan and Korea.

History, Mr. Chairman, is important. When you ignore it, you're bound to repeat it.

The last time Congress looked at routes to ship Alaska gas, it never considered any other market but the United States.

We forgot the history. Alaska, at the top of the Pacific Rim, has its natural markets in the Orient.

Accomplishments are made by those who try. That's why Yukon Pacific was formed. We believe America has nothing to lose and everything to gain, by trying to sell that North Slope gas in the free market.

In strict legal terms, I do not believe the law restricts the North Slope producers and the State of Alaska from selling their gas anywhere in the world, including the Pacific Rim. 5/

Yukon Pacific has begun to apply for the permits necessary to construct a pipeline across Alaska.

Our intended market is the Orient, Japan, Korea, and Taiwan.

5/ See "Trans Alaska Gas System, Economics of an Alternative for North Slope Gas, Report by the Governor's Economic Committee, January 1983," Legal Analysis, page six. Question: Can North Slope Gas be exported?

> The linchpin is Presidential approval. Under ANGTA (15 U.S.C. 719 (j)), export of more than 1,000 Mcf per day of Alaska North Slope natural gas to countries other than Canada or Mexico must receive Presidential approval in order to be permissible, and that approval must be based on a finding that such exports "will not diminish the total quantity or quality, nor increase the total price of energy available to the United States."
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> . . . We are not predicting that the President will make such a determination, only that an objective review of today's domestic energy picture leads to the conclusion that the section 719 (j) restrictions should not be over-estimated. There are other federal statutes that must be satisfied before natural gas, in LNG form, can be exported. These requirements may be found in the Natural Gas Act, the Export Administration Act, the Energy Policy and Conservation Act, and the Natural Gas Policy Act. While these requirements cannot be overlooked, we believe that were the President to make a section 719 (j) finding in favor of North Slope gas exports, the other requirements would fall by the wayside.

But, Mr. Chairman, even if the law says you can do it, it is hard to sneak an 820-mile pipeline across Alaska in the dark of night.

We believe Congress, which sets policy in this country, should take a neutral stand with regard to which pipeline gets this gas to market.

Legislation we seek is simple. First, we do not need to change A.N.G.T.A. as much as clearly state that it does not bestow an exclusive franchise to ship North Slope gas. Second, legislation similar to that enjoyed both by the Trans-Alaska Oil Pipeline System and A.N.G.T.S. to expedite permitting and remove the threat of long term litigation would help T.A.G.S. as well.

We're not suggesting a drastic change in national policy.

Let me show you how what we're proposing is consistent with America's other goals.

In energy policy, our goal has been production. There is a consensus in America, Mr. Chairman, that where environmental concerns are ironed out, energy production should go on.

In Alaska, we're never going to produce our potential oil reserves without shipping our gas.

There seems to be something inherently wrong when major energy companies turn away tracts with high oil potential on the North Slope, simply because they have high gas potential too.

Let's do everything we can to get that gas to market.

It will help us produce more oil.

In trade policy, our goal has been to balance our trade with our trading partners.

Somehow the idea that we help ourselves and hurt Japan by refusing to sell them energy has turned things upside down.

We certainly don't help ourselves with a balance of trade that was in Japan's favor last year by eighteen billion dollars.

We have to sell Japan what it needs. We can't sell them harnesses if they don't have horses. What they need is energy.

Mr. Chairman, experts on both sides of the Pacific agree that the best way to balance our trade with Japan is in trading energy.

It is a way to expand the opportunities of both countries.

I believe that is what America looks for when it trades around the world.

Another national policy goal has been strengthening our ties with Pacific nations, and boosting our national security.

To me, Mr. Chairman, national security is gained through exchange and common interests.

Countries that trade together stay together.

When we told Japan ten years ago that we weren't going to sell them energy, they didn't stop. They went to other nations.

Australia, Canada, Malaysia, Indonesia, Abu Dhabi, Thailand, and even the Soviet Union have moved to fill the bill for natural gas. 6/

Alaska pioneered the market for L.N.G. in Japan in 1969. We had 100 percent of the market share. We shipped a million tons to Japan per year then, and we still ship a million tons.

6/ See "History and Forecast of LNG in Japan," graph from "Future LNG Marketing in Japan," report by Nissho Iwai Corporation, October 1983, page 5, appended to this testimony.

Today we ship one million tons out of eighteen million tons. In 1990 we'll have one million tons out of 37 million tons.

Where is the Yankee trader? No wonder our trade is out of balance.

Our market share is reduced to less than three percent. We can compete in Japan. It is not that we couldn't, we wouldn't.

In conclusion, Mr. Chairman, all we're asking for is the right to compete again. We want our government supporting us as we attempt to make the trade. Our competition has it. We shouldn't deny it to ourselves.

It is only Congress that has, as a body, yet to realize the positive benefits to America in trading energy.

"Whether this gas is marketed in the United States or abroad, it reduces a demand for OPEC and Soviet energy and clearly results in significant benefits to the U.S. economy," Commerce Secretary

Malcolm Baldrige wrote Alaska Governor Sheffield last spring. 7/

"The United States and its allies continue to work together to develop effective techniques for improving international energy security," reported the Department of Energy in its National Energy Policy Plan.

"Special emphasis is being placed on diversifying the sources of foreign oil supply and avoiding undue dependence on unreliable sources of energy. Thus energy trade is likely to be an increasingly important aspect of international energy activity, and the United States ought to seek to increase its role as a reliable, cost-competitive energy trade partner," the report concluded. 8/

"Each country will . . . continue to develop strong and cost-effective energy policies based on that combination of market forces and government action which is best suited to its circumstances, but including . . . seeking to remove impediments to its trade in energy . . . (and) cooperation on a regional

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7/ Letter from Secretary of Commerce Malcolm Baldrige to Alaska Governor William Sheffield, June 17, 1983.

8/ United States Department of Energy, National Energy Policy Plan (1983) Page 3.

basis or as otherwise appropriate to improve the overall flexibility of energy systems and to overcome transit problems."

That statement is from a communique signed by the members of the governing board of the International Energy Agency, meeting in Paris in May. The U.S. is a member. 9/

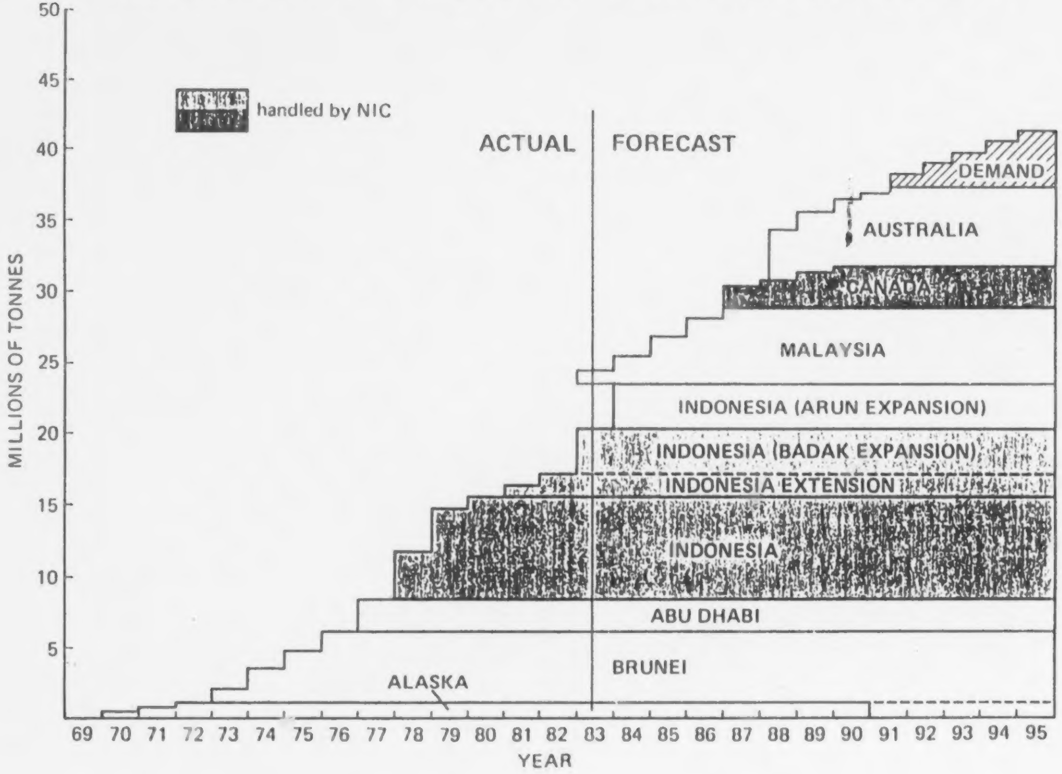
Mr. Chairman, my point: America has agreed to pursue a policy of free trade in energy that needs to be backed up by Congress.

With Alaska North Slope gas, we have nothing to fear from freedom. You have heard the story of Yukon Pacific today, and what we seek to do.

We may fail, but for us to fail will cost the U.S. nothing. We cannot succeed, however, unless we can try, and that is why we are asking Congress' help today.

9/ See "Communique, International Energy Agency, Meeting of Governing Board at Ministerial Level, 8th May, 1983," page 5.

HISTORY AND FORECAST OF LNG TRADE IN JAPAN



Senator **Murkowski**. Next witness. Mr. Thomas, we welcome you.

STATEMENT OF O. PENDLETON THOMAS, PRESIDENT AND CHIEF EXECUTIVE OFFICER, YUKON PACIFIC CORP.

Mr. **Thomas**. I'd like to thank you for the opportunity to be here today, and at the same time thank my colleagues for their appearance here.

I'd like to clarify one thing you said. I'm actually from Houston. I think Wally is perfectly capable of caring for the Alaska responsibility in this organization along with—and I'll try to carry on responsibilities.

Senator **Murkowski**. You had an opportunity to be an Alaskan and you denied that. And you're going to have to settle that with Governor Hickel.

I do apologize, it says you're from Anchorage, and I know very well you're from Houston.

Mr. **Thomas**. I'd like to put my printed testimony in the record.

Senator **Murkowski**. It will be entered in the record.

Mr. **Thomas**. It was prepared before the release was made of the results of the sessions that took place over in the Far East during the President's visit.

And I want to complement the Joint NG Study Group for what it was successful in achieving over there. It came about after months and months of very diligent work. And I'm very pleased with the results of those sessions and that work.

We intend to have meetings with certain of those participants. And particularly Bill Martin who headed up our delegation over this period of time, while we're here in Washington, to learn a little bit more about the underlying factors that brought about this good result.

So, we're looking forward to those sessions over the period of the next couple of days.

We intend also to make a trip to the Far East in the not too distant future. Our present plans were to go there before the end of this year to pick up contacts in these three countries, which we expect to be candidates for purchasing this gas.

We think we need to learn a little bit more of what they have on their mind. And hopefully have the opportunity of discussing the type of studies that should be undertaken and were contemplated at the time that these energy study group meetings took place over there.

So, we hope to come back with a lot better knowledge and information. And we feel that time is of the essence, and we should get this underway at the earliest.

We propose to ask that this TAGS become a nonjurisdictional facility. This is an intrastate line that has been described to you and, as you see on the chart up here on the easel, the facilities would all be within the State of Alaska. And we think that there's no reason why FERC should have jurisdiction over these facilities. And we intend to request, that they be classified as a nonjurisdictional facility.

In discussing the Far East market and ANGTS market, I think it's appropriate for us to say that we do not feel that these are competitive projects. They may be in conflict in the sense that both of us are vying for the same gas. On the other hand, as I will discuss later, I think there's ample gas supplies up there, gas resources for both projects. If there's not at the present time, that the additional exploratory work that's going on up there is certainly going to come up with a sufficient additional gas reserve, so that there will be enough gas for everyone.

The reason I classify them as two different markets, in the true sense of the word is, that in this country gas is priced not on the basis of the economics of the commodity, but strictly on the basis of political dictations. As a result, gas is priced at an unrealistically realistically low level. And there's no reason, unfortunately, to believe that there's going to be any change in that in the foreseeable future in light of what's happened in the Senate in the last day or two. And some of the projections are coming out of the House as well.

The market in Japan, on the other hand, is different; and their gas has always been priced on the basis of its Btu value in comparison with oil. And as a result gas sales there are significantly higher priced at the present time than gas sales in the lower 48 States of this country.

We want to take advantage of that differential. And we think it is an important aspect of our situation that may permit us to develop a viable economic project. Whereas, ANGTS has been unable to obtain financing up to this point.

I do want to emphasize the point that we do not consider these competitive projects. As a matter of fact, as Governor Hickel indicated, we have proposed that we have the common line all the way down to Fairbanks with enough capacity to supply both of these facilities. This would result in significant economies for both of us. And we think it makes an awful lot of sense, and we have been pursuing that diligently in our conversations with everyone that will listen to us.

Now, to summarize what is incorporated in my paper, I'd like to mention, No. 1, the discussion there of gas reserves. I always like to be authoritative in matters of that kind. And so I'd like to introduce into the testimony the National Petroleum Council's study of U.S. gas, which came out in December of 1981. This is as far as I knew the latest authoritative study that has been made in this regard. And reference has already been made to it here today. But I think it should be really part of the record.

Senator MURKOWSKI. It will be noted in the record, as if written. Might you for clarification for the benefit of those that are here. If you have it available—what it says about reserves.

Mr. THOMAS. I think it might be preferable if I read from the report itself. But I think it would be easier to find in my own paper. I do not have any disagreement with the fact that at the present time the proven gas reserves of Prudhoe Bay are somewhere probably in the 26 to 29 trillion cubic feet area.

The capacity of the ANGTS line would be almost a trillion cubic feet per year. So this represents somewhere between 26 and 29 years of reserves in that source alone.

I'm reading that from my paper.

North Slope gas reserves to be discovered are many and varied. National Petroleum Council issued estimates in December 1981 using averages of other studies. They put undiscovered potentially recoverable resources of the North Slope and the Bering Sea at a mean of 24 billion barrels of oil, and a high of 55 billion barrels, and 100 trillion cubic feet of natural gas; a high of 246 trillion cubic feet.

Senator MURKOWSKI. Thank you, please proceed.

Mr. THOMAS. The point I wanted to make, of course, is we feel there's enough gas reserves up there to accommodate these projects. And for that reason, in addition to those already cited, we do not consider this to be a competitive project.

The next point I'd like to mention is the matter of legislation, which has already been referred to.

Governor Hickel indicated that our lawyers—that the law that's already on the books may not prohibit the export of natural gas. On the other hand, if you look at it from a practical point of view, I don't think it would be possible to sign up customers, and to obtain financing and to do the other things that would be required without some specific legislation.

I have had sessions along with some of my associates; with you and others in the Senate; members of the House; including Congressman Dingle. And I have not seen any organized opposition, up to this point, against giving us appropriate legislation to give us an opportunity along side ANGTS to develop a viable project, if in fact such a project can be developed.

The third matter which I will refer to is markets. We have such an interest on the part of the Koreans, that we have a Korean, Mr. J.K. Kim, who has come to Washington today to discuss with us the interest of the Koreans in gas from the North Slope.

We have some other numbers which are incorporated in my paper here, which indicate the gas market, or the potential gas market that might be available in Japan and in Taiwan, as well as Korea.

We feel there is a market over there. There will be at the right time, if we can get all the necessary details worked out.

In summary, we feel the options should be available to Yukon Pacific to develop for sale the reserves of gas on the North Slope, and we intend to work with the producers and with the countries where we think a market exists, with the Federal Government, with the State of Alaska, and others who have a stake in this matter to try to bring that about.

Thank you.

Senator MURKOWSKI. Thank you.

[The prepared statement of Mr. Thomas follows:]

STATEMENT OF O. PENDLETON THOMAS
BEFORE THE ENERGY REGULATIONS SUBCOMMITTEE
OF THE ENERGY AND NATURAL RESOURCES COMMITTEE
OF THE UNITED STATES SENATE

November 16, 1983

Mr. Chairman, members of the Committee, I am O. Pendleton Thomas, president and chief executive officer of Yukon Pacific Corporation. Thank you for the opportunity to be here today.

With me, prepared to address this committee, are two individuals whose work is vital to the goals of Yukon Pacific. You have heard from Governor Walter J. Hickel, our company's chairman. He was formerly co-chairman, with Alaska's Governor William A. Egan, of the committee which initially proposed a trans-Alaska gas system to the state of Alaska in January of this year. [1]

Peter M. Flanigan is Managing Director of Dillon, Read and Co., an investment banking firm. His firm conducted a set of economic analyses on the Governor's Committee proposal. Mr. Leigh Cox is manager of pipeline engineering for Brown and Root. His firm drew up the initial specifications and cost estimates for the Governor's Committee.

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[1] Trans Alaska Gas System, Economics of an Alternative for North Slope Gas, Report by the Governor's Economic Committee on North Slope Natural Gas, Anchorage, Alaska, January 1983.

Yukon Pacific Corporation is a private company, formed in Alaska this September, with the goal of constructing the Trans-Alaska Gas System, an 820-mile pipeline to carry North Slope natural gas to tidewater on Alaska's south coast where it would be conditioned, liquefied, and shipped to markets in the Far East. 2/ We see ourselves as the convenor of the forces necessary to do the job--someone who can bring together the buyers and sellers of the gas and their respective governments.

Mr. Chairman, today I want to talk about several things. First, I would like to direct your attention to the tremendous gas potential on the North Slope and the need to pursue every alternative to get this gas to market. Second, I would like to endorse and reiterate Governor Hickel's call for legislation that would clear up any incompatibility that now exists between ANGTS and TAGS. Third, I'd like to share with the committee our ideas of how we plan to make this project happen, given what we know

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2/ Directors of Yukon Pacific Corporation, announced with the company's formation on September 13, 1983, include, besides myself and Governor Hickel, Mr. Lawrence J. Kelley, Governor William A. Egan, Edward D. Loughney, William H. Blackledge, Loren H. Lounsbury and William H. Bittner.

now about the regulatory climate in the United States and the market potential of the Pacific Rim.

Yukon Pacific Corporation will shortly begin applications for a permit to construct a 48-inch diameter gas pipeline from Prudhoe Bay to Fairbanks, to be continued with a 36-inch pipeline to a tidewater location on Alaska's south coast.

This proposal differs somewhat from the proposal of the Governor's Economic Committee for a 36-inch pipe over the entire route. We have proposed this size pipeline out of a conviction that there is much more natural gas to be found on the North Slope of Alaska than is known to exist there today.

Estimates of North Slope gas reserves to be discovered are many and varied. The National Petroleum Council issued estimates in December 1981 using averages of other studies. They put undiscovered potentially recoverable resources for the North Slope and the Bering Sea at a mean of 24 billion barrels of oil (a high of 55 billion barrels) and 109 tcf of natural gas (a high of 246 tcf.) 3/ Those estimates were based on current energy

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3/ U.S. Arctic Oil and Gas, December 1981, National Petroleum Council Report to the Secretary of Energy, Table 1, p. 18.

market conditions. A 1981 U.S.G.S. study put the Alaska's onshore and offshore recoverable potential at a high of 172 tcf of gas, with a mean estimate of 109 tcf. 4/

Prudhoe Bay is estimated to hold 26 trillion cubic feet of developed recoverable reserves. With discoveries in the area of a realistic percentage of these estimates, I am confident there will be sufficient Alaska gas to supply two pipelines--one serving domestic markets and the other serving international markets. Our second pipeline, serving Pacific Rim markets, is not intended as either a replacement of or a competitor to ANGTS. We see it as complementary.

Mr. Chairman, during today's hearing you will receive testimony from the three major North Slope producers and others doing business on Alaska's North Slope. I have served on the board of one of those companies, ARCO, and led Sinclair, a company which--before it was merged into ARCO--was a pioneer explorer in that frontier region. I can testify from my own experience, and I am sure you could get others in the business here today to agree with me, that the absence of a transportation system to

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4/ U.S. Department of Interior Geological Survey, Estimates of Undiscovered Recoverable Resources of Conventially Producible Oil and Gas in the United States; Open-File Report 81-192, p. 6.

move natural gas out of Alaska is one of the largest deterrents to further exploration in that promising frontier.

Undoubtedly much of the promising natural gas figures I read to you before will be found in association with oil. If gas is found at all under current conditions, it will be because those doing the exploring are looking for oil. The problem, Mr. Chairman, is that as long as there is a substantial chance that gas must be expensively reinjected, that basic oil exploration effort is impeded. The federal government sees the effects in many ways. There is less interest in bidding on some tracts at all. Some tracts that are bid upon command lower prices because bidders have discounted the probable costs of gas reinjection when figuring their range of returns. Finally, if and when discoveries are made, the chances they would be economic to produce in that region is limited by the costs brought upon by the amount of gas found that can't be produced.

I cannot tell you how much drilling is not going on because of our failure, so far, to provide transportation for gas to market. Nor can I tell you how much oil is not being produced today because there is no gas pipeline. I can say that testimony given by one of the Prudhoe Bay operators before the Alaska State Legislature in 1982 indicates that when gas sales from Prudhoe

Bay begin, an increase in oil production of up to 100,000 barrels of oil per day will become feasible by allowing production of high gas-oil ratio wells which otherwise would be shut-in.

I must stress that the ultimate oil recovery from Prudhoe Bay is not diminished by the lack of gas sales, but the cost of oil recovery and the timing of that field's contribution to the free world's energy supply is affected. 5/ It could diminish, however, the amount of oil economically recoverable from marginal fields because of the high cost of reinjecting the gas.

What does all of this mean to the United States and government policy with regard to transporting that gas?

I believe we have an obligation to get the gas to market by any economic means, including exporting it. If no other market is available in the near term, the cash flow generated from the sale will permit additional exploration which should result in incrementally developed reserves of both oil and gas. Further, additional royalties and taxes will accrue to the Federal Government and the State of Alaska as well as higher lease bonuses when acreage is offered for sale.

5/ Effect of Delayed Gas Sales on Prudhoe Bay Performance and Development, testimony by Atlantic Richfield Co. before the Alaska State Legislature, 1980.

Mr. Chairman, this leads me to my second point. I endorse Governor Hickel's call for legislation to make TAGS compatible with ANGTS. I hope the sponsors of ANGTS will agree that both projects have the objective of moving this gas to market.

As Governor Hickel said, in strict legal terms we believe ANGTA does not preclude gas exports. Indeed, Section 12 of that law, 15 U.S.C. § 719j, which requires findings and makes provisions for a President to approve exports of Alaska gas to countries other than Canada or Mexico, implies an export pipeline is possible. But in order to achieve financing and conclude sales agreements, we consider legislation absolutely necessary.

We would like a clear indication from Congress that it supports attempting to market this gas abroad, and hence we are asking for a specific authorization in this regard. Today, there is a conception that the Alaska Natural Gas Transportation System has an exclusive right to market this gas and we consider it advisable to clarify the point.

We have no desire to hurt Northwest, the holder of that permit. But we do not believe it is in the national interest for them to hold the only option to market the gas.

Second, we also seek legislation that extends the same protections from litigation enjoyed by ANGTS and the Trans-Alaska Oil Pipeline. This is too big a project to undertake with the risks it can be stopped once construction has begun.

Finally, Mr. Chairman, I would like to summarize what I see is the key economic opportunity for the United States presented with the project to export natural gas in the Pacific Rim.

I find it very exciting. That's why I got involved.

Japan is the world's largest user of liquefied natural gas today. That country began with one million tons from Alaska in 1969, and uses about eighteen million tons today. In 1990, according to the Long Term Energy Demand-Supply Outlook prepared by Japan's Ministry of International Industry and Trade in August 1983, that country will more than double its LNG use to at least 36 million tons per year. In 1995, according to those estimates, Japan will use 41.8 to 43.36 million tons of LNG.

Japan has begun to make contracts to fulfill that demand. Besides those contracts which are in place today, two major projects are now projected to fill that demand in 1990. Canada has contracted to sell approximately 3 million tons. Australia has contracted to sell approximately 8 million tons.

In the August MITI report, the Japanese government had revised downward its projected LNG demand from a forecast need of 43 million tons LNG in 1990 which was released in April of last year. That downward revision, we are advised, came about with an overall revision of Japan's total energy need projection. In the last year, Japan estimated that it would need 23 percent less total energy in 1990 than it projected the year before. That major assumption, we are told, is a result of Japan's own revised expectation of economic growth.

Mr. Chairman, we admit there is a risk that there will not be a market for this gas in Japan until the middle of the 1990's. We have sought to account for that risk in several ways.

First, as sales proposals are presented by Yukon Pacific, we intend to be as flexible as possible and to encourage the owners of the gas to do the same. Flexibility on our part includes encouraging buyers to consider taking an equity interest in the pipeline.

Second, we believe the projections of Japanese demand announced this August are not firm. They will change again with expectations of economic growth, just as they have changed before.

Third, while Yukon Pacific seeks to sell 14.5 million tons per year in the Pacific Rim market, it may be advisable to begin shipping a smaller amount of natural gas through the pipeline and step up shipments to the full capacity later. Mr. Flanigan can have more to say about that: our feeling is that we must get commitments to purchase the full amount of the gas to achieve financing, but it may not be imperative that we ship the full amount initially.

As an aside, Mr. Chairman, we are not deterred by projections of limited demand for LNG because we are aware of the fuel's environmentally sound qualities, the changing role of nuclear fuels, and the fact that Pacific Rim manufacturing enterprises use a much lower percentage of natural gas than their counterparts in this country. That market has potential--we believe it is worth our time and worth the effort of the United States government toward achieving such an objective.

I have spoken at length about the market potential in Japan. We are enthusiastic as well about the prospects of selling natural gas in Korea and Taiwan.

The Energy Supply/Demand Plan of the Republic of Korea prepared in September of this year projects that nation will use approximately 76 to 81 million tons of oil equivalent in 1991 and

94 to 105 million tons of oil equivalent in 1995. That country is one of the blossoming developing nations of the Pacific, Mr. Chairman, and they need to import energy.

Korea right now uses no LNG. The Indonesians have pioneered the market, contracting to deliver approximately two million tons per year to 1988. That gas, by the way, was the same gas Indonesia had been planning to ship into California when North America's potential to supply itself was underestimated.

In Japan, about 6.9 percent of the country's total energy supply is handled by LNG. We believe that by the middle of the 1990's Korea will want to have the same percentage supply of LNG in its energy picture, and we see Alaska as a potential supplier.

Mr. J. K. Kim, an American businessman of Korean birth, has independently been working to explore this market. If Korea decides to increase its use of LNG in the 1990's to the percentage level Japan consumes today, that country could buy 2.5 million tons per year in 1991, increasing to 9 million tons per year by 1999.

Korean policy on LNG use is not established. But we know they need energy, and I believe the United States can take advantage of this requirement to strengthen the growing trade between our nations and keep our trade in balance.

Likewise, Mr. Chairman, Taiwan consumes no LNG today. Their goals for 1990 are, as yet, uncertain. China Petroleum Corporation has already begun discussions with Indonesia on LNG, and they are considering a trade of 1.5 million tons per year in 1990 increasing to 3 million tons in 1994.

To summarize the market opportunity for Alaska gas in the Pacific Rim, Mr. Chairman, we need initial purchase commitments of five to ten million tons delivery in the early 1990's to be increased to 14.5 million tons by the middle part of the decade to meet our schedule. We believe those markets are possible. Commitments are being made now, and America can play an important role.

Mr. Chairman, this is an enormous project with tremendous lead times. Government's best role is to encourage. We have competitors in the marketplace. Competitive advantage in energy goes to those who can use every resource at their command to achieve their objective.

I hope Congress will join us in this effort. Thank you.

Senator MURKOWSKI. The next gentlemen, Mr. Cox, manager of the Pipeline Engineering Department for Brown & Root, Houston, Tex.

Please proceed.

STATEMENT OF LEIGH COX, MANAGER OF THE PIPELINE ENGINEERING DEPARTMENT, BROWN & ROOT

Mr. COX. Thank you, Mr. Chairman.

I am Leigh Cox, manager of the Pipeline Engineering Department of Brown & Root, and I would like to express my pleasure of being here today to represent Brown & Root and present this testimony concerning Brown & Root's involvement with the Alaskan Governor's Economic Committee and its report on the economics of an alternativer for North Slope gas.

In 1982, Brown & Root was asked to serve as engineering consultants to the Governor's Economic Committee during its study of the Trans-Alaska Gas Pipeline System.

We were pleased to serve in this capacity and subsequently provded the engineering input for the committee report published in January 1983.

When we originally agreed to participate in this study, it was understood that it would be essentially a preliminary feasibility study in which existing file data and experience would be used.

Our previous experience was to be relied upon heavily and site visits would be required and be conducted but no detailed survey would be conducted.

Within these parameters, we prepared the engineering section of the Governor's Economic Committee report.

At this time, I would like to introduce into the record the Governor's Economic Committee report.

Senator MURKOWSKI. It will be submitted in the record.[1]

Please proceed.

Mr. COX. I would like to discuss some of the highlights of this study.

One of the first conclusions drawn was that a so-called dense phase pipeline would be feasible, thus allowing less expensive treatment of the gas at a tidewater location.

Dense phase flow will require that the pressure in the pipeline be maintained at a pressure greater than 1,420 pounds per square inch gage. The pipeline will be designed to operate with a minimum station inlet pressure of 1,660 pounds per square inch gage and a maximum station outlet pressure of 2,160 pounds per square inch gage. Brown & Root has just recently engineered this same concept into a pipeline system in the North Sea.

Dense phase gas transmission allows the gas treatment facilities to be located at tidewater, thus reducing the cost of construction compared to the cost if constructed on the North Slope. The processing facilities that are required are those for carbon dioxide removal, natural gas liquids extraction, and fractionation to recover propane and other liquid hydrocarbons.

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[1] The text of the Governor's Economic Committee report appears, as app. II.

In addition, the natural gas will be liquified and stored for shipboard loading and subsequent shipment to LNG markets on the Pacific rim.

As developed in our section of the Governor's Economic Committee report, the transportation system would consist of compression of the raw Prudhoe Bay gas on the North Slope to a pressure above 1,660 pounds per square inch gage, refrigeration to maintain gas temperature below 25 degrees Fahrenheit and construction of some 820 miles of 36-inch pipeline to Nikishka on the Kenai Peninsula.

Compressor stations would be built as needed and would be a feature of the phase construction schedule to be described later. It should be mentioned that Nikishka was selected as the site for the liquefied natural gas terminal after considering several other locations, but additional studies should be conducted before a final termination point is decided upon.

Gas treatment and processing facilities described earlier would be constructed. During our study, we divided the project into three phases representing three different capacities or transportation requirements for the system.

It was always assumed that phase I would be succeeded by phase II and that phase II would be succeeded by phase III in the same pipeline system. Phase I would not be a standard load system.

Phase I was composed of the 36-inch pipeline having a capacity of 950 million standard cubic feet per day of raw gas and requiring one intermediate compressor station.

Phase II was the same 36-inch diameter pipeline with seven intermediate compressor stations and a capacity of 1,720,000,000 standard cubic feet per day of raw gas.

Phase III would be comprised of 14 intermediate compressor stations and have a capacity of 2,830,000,000 standard cubic feet per day of raw gas.

In terms of 1982 dollars, the estimated cost for phase I is $7.2 billion; for phase II is $10.3 billion; and for phase III is $14.3 billion.

It should be noted that these costs are not additive, but are cumulative.

The items that have gone into the estimate include the pipeline, the compressor stations and refrigeration, carbon dioxide removal facilities, natural gas liquid extraction, natural gas liquid fractionation, natural gas liquid storage and loading facilities, liquidied natural gas production and storage facilities, loading terminals and organization costs. Engineering project management and contingency are included in all elements of the estimate.

As envisioned in the report, the three-phase schedule for construction of the system would require 5 years for the initial phase and 2 more years each for the second and third phase or a total of 9 years for design and construction of all three phases. If phasing were eliminated, the total construction period could be accelerated.

Mr. Chairman, let me conclude my brief remarks by saying that much work remains to be done to complete the engineering already started in our work for the Governor's Economic Committee. None of the problems remaining is unsolvable. Most have been addressed before, and the solutions are at hand. The feasibility of the concept has been proven and the economic analysis looks attractive. Now, it remains to get on with the job and get it done.

Senator **Murkowski**. Thank you.
[The prepared statement of Mr. Cox follows:]

TRANS ALASKA GAS PIPELINE
TESTIMONY TO
SENATE SUBCOMMITTEE ON ENERGY REGULATIONS

Mr. Chairman and honorable members of the committee, I am Leigh Cox, Manager of the Pipeline Engineering Department of Brown & Root. I am pleased to be here today to represent Brown & Root and present this testimony concerning Brown & Root's involvement with the Governor's Economic Committee and its report on the economics of an alternative for North Slope gas.

Brown & Root has been involved in pipeline projects in Alaska since the Alyeska Pipeline was designed and constructed from Prudhoe Bay to Valdez. We gained additional Arctic and Alaska pipeline experience in a project for British Petroleum on the North Slope during the early 1970's. In 1982, we were asked to serve as engineering consultants to the Governor's Economic Committee during its study of the Trans Alaska Gas Pipeline System. We were pleased to serve in this capacity and subsequently provided the engineering input for the committee report published in January 1983.

When Brown & Root originally agreed to participate in the study, it was understood that it would be essentially a preliminary feasibility study in which existing file data would be used. Our previous experience was to be relied upon heavily and site visits would be required and conducted but no detailed survey would be required. Within these parameters, we prepared the engineering section of the Governor's Economic Committee report.

I should like to discuss some of the highlights of the results of our study.

- One of the first conclusions drawn was that a so-called dense phase pipeline would be feasible, thus allowing less expensive treatment of the gas at a tidewater location. A dense phase pipeline is one in which the raw gas is transported at a pressure and temperature such that all components are in a single phase rather than gas and liquids being transported in a two-phase flow. Dense phase flow will require that the pressure in the pipeline be maintained at a pressure greater than 1420 psia. The pipeline will be designed to operate with a minimum station inlet pressure of 1660 psig and a maximum station outlet pressure of 2160 psig. Brown & Root has just recently engineered this same concept into a pipeline system in the North Sea.

Dense phase gas transmission allows the gas treatment facilities to be located at tidewater, thus reducing the cost of construction compared to the cost if constructed on the North Slope. The processing facilities that are required are those for CO_2 removal, natural gas liquids extraction, and fractionation to recover propane and other liquid hydrocarbons. In addition, the natural gas will be liquified and stored for shipboard loading and subsequent shipment to LNG markets on the Pacific rim.

o As developed in our section of the Governor's Economic Committee report, the transportation system would consist of compression of the raw Prudhoe Bay gas on the North Slope to a pressure above 1660 psig, refrigeration to maintain gas temperature below 25°F and construction of some 820 miles of 36" pipeline to Nikishka on the Kenai Peninsula. Compressor stations would be built as needed and would be a feature of the phase construction schedule to be described later. It should be mentioned that Nikishka was selected as the site for the LNG terminal after considering several other locations, but additional studies should be conducted before a final termination point is decided upon.

o Gas treatment and processing facilities described earlier would be constructed. During our study, we divided the project into three phases representing three different capacities or transportation requirements for the system. It was always assumed that Phase I would be succeeded by Phase II and that Phase II would be succeeded by Phase III in the same pipeline system. Phase I was composed of the 36" pipeline having a capacity of 950 million standard cubic feet per day of raw gas and requiring one intermediate compressor station. Phase II was the same 36" diameter pipeline with seven intermediate compressor stations and a capacity of 1,750,000,000 standard cubic feet per day of raw gas. Phase III would be comprised of 14 intermediate compressor stations and have a capacity of 2,830,000,000 standard cubic feet per day of raw gas.

- In terms of 1982 dollars, the estimated cost for Phase I is $7.2 billion, for Phase II is $10.3 billion, and for Phase III is $14.3 billion. It should be noted that these costs are not additive but are cummulative. The items that have gone into the estimate include the pipeline, the compressor stations and refrigeration, CO_2 removal facilities, natural gas liquid extraction, natural gas liquid fractionation, natural gas liquid storage and loading facilities, liquified natural gas production and storage facilities, loading terminals and organization costs. Engineering project management and contingency are included in all elements of the estimate.

- As envisioned in the report, the three-phase schedule for construction of the system would require five years for the initial phase and two more years each for the second and third phase or a total of nine years for design and construction of all three phases. If phasing were eliminated, the total construction period could be accelerated.

Mr. Chairman, let me conclude my brief remarks by saying that much work remains to be done to complete the engineering already started in our work for the Governor's Economic Committee. None of the problems remaining is unsolvable. Most have been addressed before and the solutions are at hand. The feasibility of the concept has been proven and the economic analysis looks attractive. Now it remains to get on with the job and get it done.

Senator MURKOWSKI. Mr. Flanigan.

STATEMENT OF PETER M. FLANIGAN, MANAGING DIRECTOR, DILLON READ & CO., INC.

Mr. FLANIGAN. Thank you.

Dillon Read is a New York investment bank which has a 50-year history in the financial development of and association with the natural gas industry.

Since 1946, we have managed or comanaged over $7 billion of natural gas industry financing, and it is interesting that the dominant forces in the natural gas industry today were the project financings in the thirties, and the forties, and indeed the fifties.

As an example, in the late 1940's, Dillon Read, with others, organized the Texas Eastern Transmission Corp. which purchased the "Big Inch" and "Little Big Inch" pipelines from the U.S. Government, and today it is one of the country's great and leading energy transportation companies.

We at Dillon Read were asked by the Governor's Economic Committee on the export of Alaskan energy to Japan to review the prospective economics of the proposed Trans-Alaska Gas Pipeline System, based on preliminary engineering costs and project design characteristics provided, as you just heard, by Brown & Root, and marketing information provided by the committee's marketing advisers.

Chapter 3 of the committee's report which was just put into your testimony, was the result of this study, and that is the subject on which I have been asked to testify today.

The study developed base analyses which estimate the prospective capital costs of the project at completion, including inflation, interest, and financing costs during the construction period; the estimated prospective operating tariffs to cover system costs of delivering and processing gas in south Alaska, and prospective economic values for Prudhoe Bay gas measured by the difference between the cost of the System LNG delivered in Japan and the prospective market value of the gas in Japan.

The key assumptions made in the analyses include the Brown & Root construction, organization and operating and maintenance costs, private investor project financing, unregulated Stem tariffs, Japanese market prices, as well as financial assumptions as to capital structure, debt, interest rates, return on equity, inflation, price increases, and tax consequences.

The base analyses determine a range of prospective tariffs to reflect current uncertainty as to project risk allocation and therefore a higher and lower rate of return.

The economic analyses have relied on cost data and assumptions subject to change and modification as this analysis develops and as economic and financial conditions change. So, for those reasons, the following tariff results should be considered as indicative of order of magnitude and should not be viewed as definitive.

At completion, the system should be capable of transporting and processing 2.83 billion cubic feet of raw gas from Prudhoe Bay to a south Alaska port. The prospective capital cost of the total system, in as-spent dollars by 1992 would be $25.5 billion and the prospective tariffs to deliver the gas and treat it and turn it into LNG in south Alaska, 1988 dollars per million cubic feet would at the lower range be $4.67, according to this economic study, and at the higher range, $6.16.

Based on the projections of the marketing advisers the analyses assume an average shipping cost, including the costs of LNG lost through evaporation in transit of about $1 per million Btu's in 1988 dollars.

The difference between the prospective tariffs and shipping costs of system LNG delivered in Japan, and the projected Japanese LNG market price, based on the projections of the Mitsubishi Research Institute, stated in 1988 dollars, indicates the economic value of the North Slope gas.

Assuming, as the Mitsubishi Research Institute did, that the Japanese LNG prices would be $7.89, and that the lower tariff rate is $5.60 for LNG delivered in Japan, that left an economic value of the North Slope gas of $2.22 per million Btu's.

Therefore, for reasons already stated, the tariff costs were higher, that value of North Slope gas went down to 73 cents per million Btu.

These system LNG costs indicate that, under the assumptions used in the analysis, including projected market prices of LNG in Japan, the total system LNG could be expected to compete in the Japanese market and be capable of covering system costs and shipping costs.

Additionally, this indicates a range of prospective values for North Slope gas of between $2.22 and $0.73 per million Btu in 1988 dollars.

The relatively significant economic value at the lower tariff range—that is the $2.22—supports an inference as to the economic feasibility of the project.

On the other hand, the higher tariff range connected with higher returns on equity reflects a case which is the higher equity return is required by investors and there is also a relatively smaller economic value of $0.73 a million Btu to the gas.

We did run several sensitivity cases in the analysis which could improve the economics of the total system even in the higher tariff range. Sensitivity assumptions which could reduce system tariffs and increase values includes stretching out the system debt repayment over the life of the system on a level sinking fund basis, the potential by the State of Alaska to grant tax-exempt financing for the liquefaction facilities, and expense and interest costs for tax purposes rather than capitalizing th[illegible] during the construction period.

If it were possible as a measure of the size of these facts to implement these sensitivity cases, the economic value of the gas, even at the higher tariff rates, could be increased from $0.73 per million Btu to approximately $2.16 per million Btu's.

Clearly, a more precise analysis of the total system's economic feasibility, must necessarily depend on a more detailed study of these alternative approaches.

At the time that the study was made, the committee's marketing advisers suggested that Japanese demand for LNG would grow from the the 1982 level of approximately 17 million tons per year to approximately 30 million tons or to 28 million tons in 1985, and between 37 and 42 million tons in 1990.

To fill the gap between these projected demand levels in 1990 and current supplies, Japanese users have completed or are now in discussions on new contracts with suppliers in Australia, Indonesia, Thailand, Malaysia, Canada, and the U.S.S.R.

Although the committee believes that the Japanese market will have the potential capacity to absorb a major portion of the TAGS system LNG, the system must actively compete at an early stage with other sources of supply to ensure that timely system gas sales are available.

Whether the Japanese market will buy Alaskan LNG can only be determined after negotiations between owners of the gas and potential gas purchasers and will depend in major part on the attitude and support of both the United States and the Japanese Governments.

Thank you.

[The prepared statement of Mr. Flanigan follows:]

Testimony of
MR. PETER M. FLANIGAN
before
SENATE SUB-COMMITTEE ON ENERGY REGULATION

Introduction

My name is Peter Flanigan. I am a Managing Director of Dillon Read & Co. Inc., a New York investment bank with which I have been associated since 1947 with the exception of 10 years in public service.

Expertise

Dillon Read has a unique history in the financial development of and association with the natural gas industry. Since 1946 Dillon Read has managed or co-managed over $7.0 billion of public and private issues for the natural gas industry. To our knowledge, the amount raised by Dillon Read equals nearly one fifth of the total financing, public and private, for the entire industry. A list of natural gas companies for whom Dillon Read has arranged financing is provided below.

Dillon Read's nearly 50-year record of service to the natural gas industry has been typified by financial innovation. The dominant forces in the natural gas industry today were the project financings of the 1930's, 1940's, and, indeed, the 1950's:

- With the sale of twelve-year mortgage bonds for Northern Natural Gas Company in 1935, Dillon Read placed the industry's first long-term debt issue with U.S. life insurance companies. Dillon Read also participated in the initial public or private financings for Colorado Interstate Gas Company, Natural Gas Pipeline Company of America, Texas Gas Transmission Corporation, Tennessee Gas Transmission Company and United Gas Pipe Line Company. In connection with these offerings, Dillon Read designed indenture provisions which were to become a standard for the industry.

- In the late 1940's, Dillon Read, with others, organized Texas Eastern Transmission Corporation which purchased the "Big Inch" and "Little Big Inch" pipelines from the U.S. Government. Dillon Read arranged the financing for this purchase.

- Dillon Read was instrumental in the redesign of the traditional gas reserve certificate and acceleration provision included as part of most long-term natural gas company debt issues. The method was first used in 1972 and enabled transmission companies to continue selling long-term bonds and debentures in a period of declining reserves.

- With the financing of the Natural Gas Storage Company of Illinois, Herscher Dome Storage Project, Dillon Read arranged the first financing of an underground gas storage field as an independent entity.

- In 1974, Dillon Read originated the concept of tax-exempt financing for SNG plants under the industrial development bond provisions of the Internal Revenue Code.

- In 1976 and 1977, Dillon Read served as financial advisor in the construction and $320 million financing of the Stingray Gas Pipeline Company which extends from 110 miles offshore Louisiana to onshore interconnections.

- In 1981 and 1982, Dillon Read developed financing plans and rendered expert financial testimony before the FERC on behalf of the Trailblazer Pipeline Company. Trailblazer is a $500 million gas pipeline which was built by a consortium of companies led by Natural Gas Pipeline Company of America to bring overthrust area gas from Wyoming to eastern markets.

- Beginning in 1974, Dillon Read has served as financial advisor to several multi-billion dollar coal gasification projects including the Great Plains project which is currently under construction in Mercer County, North Dakota.

- Dillon Read serves as financial advisor to Gaz de France regarding the construction and financing of the Megel gas pipeline, a joint project of Gaz de France and Ruhrgas. To date $114 million of non-recourse financings have been arranged which are secured by throughput agreements.

U.S. Natural Gas Companies Which Have Financed Through Dillon Read

- Alaska Pipeline Company
- American Natural Resources Company
- Colorado Interstate Gas Company
- Consolidated Natural Gas Company
- Laclede Gas Company
- Kansas-Nebraska Natural Gas Company, Inc.
- Michigan Consolidated Gas Company
- Michigan Wisconsin Pipe Line Company
- Midlands Gas Corporation
- Mississippi River Transmission Corporation
- Mississippi River Fuels Corporation
- Montana-Dakota Utilities Company
- Natural Gas Pipeline Company of America
- Peoples Gas Company
- Peoples Gas Light and Coke Company
- Texas Eastern Transmission Corporation
- Texas Gas Transmission Corporation
- Transwestern Pipeline Company
- Triangle Pipeline Company
- United Gas Corporation
- Wilcox Trend Gathering System
- Wisconsin Gas Company

During my own investment banking career, I worked on several transactions for Texas Eastern Transmission Corporation, and I served as a director of United Gas Corporation for several years until its acquisition by Pennzoil. In 1982 and early 1983 I lead Dillon Read's economic study for the Governor's Economic Committee on the export of Alaska LNG to Japan

Economics of Alaskan LNG

Dillon, Read was asked by the Governor's Economic Committee to review the prospective economics of the proposed Trans-Alaska Gas System (TAGS or System), based on preliminary engineering costs and project design characteristics provided by Brown & Root, and marketing information provided by the Committee's marketing advisors. Chapter 3 of the Report which the Committee submitted to Governor Sheffield in January of this year, copies of which have been submitted as testimony to your Committee, is the result of that study, which I will now summarize.

The study developed base analyses which estimate prospective capital costs of the project at completion (including inflation, interest and financing costs during the construction period), prospective operating tariffs to cover System costs of delivering and processing gas in South Alaska, and prospective economic values for System LNG measured by the difference between the cost of System LNG delivered in Japan and the prospective market value of the gas in Japan.

Prospective System capital costs and tariffs are based on economic and financial assumptions which reflect the preliminary and limited information on the System presently available. The analyses reflect the large capital investment required for construction, the completion and marketing risks connected with an Alaska gas project, and the special characteristics associated with the System including phased construction, transportation and processing of all gas products, construction of the conditioning facilities in South Alaska, System tariffs related to market forces rather than regulatory principles, and potential export markets for System LNG.

Key assumptions made in the base analyses include the Brown & Root construction, organization and operating and maintenance costs, private investor project financing, unregulated System tariffs, Japanese market prices for System LNG, as well as financial assumptions as to capital structure, debt, interest rates, equity returns, inflation, LNG price increases and tax consequences.

The base analyses determine a range of prospective tariffs to reflect current uncertainty as to project risk allocation and required equity rate of return expectations. The lower tariff range reflects a lower rate of return on equity investment (30% after tax) on an assumption of limited equity risk, while the higher tariff range assumes increased equity risks and higher return requirements (40% after tax). All system tariffs have been calculated on a breakeven basis to recover all operating costs, fuel costs, debt service, taxes and return on and return of equity investment.

The economic analyses have relied on cost data provided by Brown & Root, and such estimates are subject to revision and reestimation as project design is refined and optimized. Furthermore, the marketing and financial assumptions used in the base analyses are preliminary and also subject to change or modification as System analysis develops and as economic and financial conditions change. For these reasons, the following tariff results should be considered as indicative of order of magnitude and should not be viewed as definitive. In order to gain perspective on System economics and feasibility in a economic environment, the analyses calculate a number of sensitivity cases including cost overruns which illustrate the change in tariffs that would occur as a result of variations in the assumptions used in the base analyses.

The System would be built in three phases and at completion would be capable of transporting and processing 2.83 billion cubic feet per day (bcf/d) of raw gas from Pruhoe Bay to a South Alaska port (the Total System). Brown & Root estimate that construction and organization costs of the Total System, including pipeline, conditioning and liquefaction facilities, over a period of nine years would approximate $14.3 billion in unescalated 1982 dollars including a 20% allowance for contingencies.

Prospective System Capital Costs and Tariffs Delivered in South Alaska

A summary of the results of the base analyses in terms of prospective System capital costs at completion and tariffs per unit of gas products delivered in South Alaska, expressed in nominal dollars per million British Thermal Units (MMBtu) in the year that initial operations are expected to commence (1988), are:

Prospective System Capital Costs

(Millions of As Spent Dollars to Completion)

Total System	$ 25,465 (1992)

Prospective System Tariffs Delivered In South Alaska

(1988 Dollars per MMBtu)

	Lower Tariff Range	Higher Tariff Range
Total System	$ 4.67	$ 6.16

Prospective Costs of System LNG Delivered in Japan Compared to Projected Japanese LNG Prices

Based on the projections of the marketing advisors the analyses assume an average shipping cost, including the costs of LNG lost through evaporation in transit (boil-off) of approximately $1.00 per MMBtu in 1988 dollars. The following summarizes the comparison of prospective costs (tariffs and shipping costs) of System LNG delivered in Japan with projected Japanese LNG market prices (based on projections of Mitsubishi Research Institute) in 1988 dollars and indicates the price differential or prospective economic value of System LNG in Japan.

Prospective System LNG Costs

Delivered in Japan Compared to Projected Japanese LNG Prices
(1988 Dollars per MMBtu)

	System LNG Costs Japan (Lower Tariff)	System LNG Costs Japan (Higher Tariff)	Japanese LNG Prices	Economic Value of System LNG (Lower Tariff)	Economic Value of System LNG (Higher Tariff)
Total System	$ 5.67	$ 7.16	$ 7.89	$ 2.22	$ 0.73

Conclusions

These System LNG costs indicate that under the assumptions used in the base analyses, including projected market prices of LNG in Japan, Total System LNG could be expected to compete in the Japanese market and be capable of covering System costs and shipping costs. Additionally, the tables also indicate a range of prospective economic values for Total System LNG of between $2.22 and $0.73 per MMBtu in 1988 dollars. The projected economic values reflect the excess of market prices over the costs of System transportation and processing. The relatively significant economic value in the lower tariff range, $2.22, supports an inference as to economic feasibility. On the other hand, the higher tariff range reflects a case which, if the higher equity return is required by investors, results in relatively little economic value, $0.73, to the gas. This economic value could be further eroded if construction costs were to escalate. In the case of a 30% cost overrun in the higher tariff case, the economic value of the gas would decline to a negative ($0.86) per MMBtu which indicates that although the System could service its debt it would not be able to achieve the higher equity return in the market place.

However, several sensitivity cases examined in the analyses could, if implemented, significantly improve the economics of the Total System even in the higher tariff case. Sensitivity assumptions which could reduce System tariffs and increase economic values include stretching out System debt repayment over the life of the System on a level sinking fund basis, potential State of Alaska tax exempt financing of the liquefaction facilities, and expensing interest costs for tax purposes rather than capitalizing them during the construction period. If it were possible to implement these sensitivity cases, the economic value of the gas could be increased from $0.73 in the higher tariff case to approximately $2.16 per MMBtu. More precise analysis of the Total System's economic feasibility, at least in the higher tariff range, must, necessarily, depend on more detailed study of these alternative approaches.

Japanese Markets, Shipping Costs and LNG Prices

At the time the study was made, the Committee's marketing advisors advised that Japanese demand for LNG will grow from the 1982 level of approximately 17 million tons per year to approximately 28 million tons in 1985 and between 37 and 42 million tons in 1990 (MITI, a Japanese governmental agency, estimated Japanese demand in 1990 at 43 million tons). To fill the gap between these projected demand levels in 1990 and current supplies, Japanese users have completed or are in discussions on new contracts with LNG suppliers in Australia, Indonesia, Thailand, Malaysia, Qastar, Canada and the U.S.S.R.

System volume is expected to total approximately 14 million tons by 1992. Although the Committee believes that the Japanese market will have the potential capacity to absorb a major portion of System LNG, the System must actively compete at an early stage with other sources of supply to ensure timely System LNG sales. Whether the Japanese market will buy Alaskan LNG can only be determined after negotiation between owners of the gas and potential gas purchasers and will depend in part on the attitude and support of both the U.S. and Japanese governments.

Senator MURKOWSKI. Thank you very much, Mr. Flanigan.

Obviously, in your capacity as managing director, you follow gas markets as a part of your official duties associated with underwriting that you have done in the past; is that correct?

Mr. FLANIGAN. I have followed them when I have such a project such as this, and in which I am personally engaged.

Senator MURKOWSKI. Do you see a parallel particularly in the conclusion of your remarks or are you expressing the realities of the economics dictating that this gas be marketed in a competitive manner with the Pacific rim as opposed to other sources of gas, and the realities of the price structure in the Pacific today, recognizing that there is Indonesian gas; there is other sources of gas; and obviously cheaper than this gas is going to be.

Is that a fair evaluation?

What do you see that is going to change that other than this gas has to be competitive? Do you see that other gas increasing so that Alaskan gas becomes competitive?

Mr. FLANIGAN. Mr. Chairman, as I understand it, the Japanese are now paying the price of LNG equivalent in Btu basis to crude oil. If they are currently paying that price, we have made assumptions here as to what is going to happen to the price of crude oil, that it would go down—in 2 years and then up with inflation thereafter.

No more than that, and that the Japanese would go on paying that price.

Senator MURKOWSKI. Is it going to happen before or after the election?

Mr. FLANIGAN. We think perhaps those forces are beyond just our election, and we think that is still going to be the relationship between LNG prices and Japan. They will move to a lower source. We don't think Indonesia is going to be selling their gas at a low price.

Senator MURKOWSKI. So, your projections, to some extent, might be similar to the projections made by the spokesman for ANGTS with regard to the market, is going to have to change and is going to have to be some realities that are presently not available to induce, actually a change in the economics, supply and demand and usage and cost to make Alaska gas competitive in Pacific market, and it is their proposal as to make Alaska gas competive in the domestic market.

Mr. FLANIGAN. I heard what was said, and I did not contradict it. I have not studied the ANGTS proposal. I was only asked to look at the economics of this, which we did.

Senator MURKOWSKI. It seems that the number applies to both proposals.

Mr. FLANIGAN. You bet. There won't be any unless the economics work.

Senator MURKOWSKI. You indicated some reference to some system in liquefication as a possible alternative. In your professional opinion, can the proposed gasline down to tidewater be financed in the private sector without Federal or State assistance?

Mr. FLANIGAN. This study was based on financing without Federal or State assistance.

Senator MURKOWSKI. And subject to the economic conclusion that you came to at the end, is it in your opinion feasible?

Mr. THOMAS. May I make a comment to that?

Senator MURKOWSKI. I have got a whole lot of questions for you. You can, please.

Mr. THOMAS. We have taken the position from the very beginning that we needed two things from the Japanese; we need a market and we need participation; and the financing of the facilities.

Senator MURKOWSKI. Participation by whom?

Mr. THOMAS. By the Japanese, and I haven't changed my mind in that regard.

Senator MURKOWSKI. Your participation doesn't include the State or Federal Government?

Mr. THOMAS. Well, the State, I think, the only thing we ever considered with respect to the State is some kind of a project, which might be tax exempt.

Senator MURKOWSKI. Similar to what was done in Valdez on the tax exempt authority? We don't know that the tax-exempt authority is going to be around by that time. It is up to scrutiny as you know, the Finance Committee.

Mr. FLANIGAN. Based on the assumptions that we set forth here, we believe that these figures are valid, and return sufficient reward both to the owners of the gas and to the providers of the capital to make it financeable, based on those assumptions.

Senator MURKOWSKI. I would assume Dillon & Read would be willing to consider underwriting of interests such as this based on these figures.

Mr. Flanigan. That is correct. If the assumptions prove correct.

Senator Murkowski. I don't know if that concludes your financing is available; I rather doubt it.

Mr. Cox, you indicated the particular techniques of bring liquefaction facility to tidewater would reduce the costs dramatically.

Is this a reduction of overall construction? I am concerned with the fact that I am a layman, that you are increasing the pressure substantially which I assume increases the cost of other things associated with the pipeline, and the compressors and so forth.

How much are you theoretically reducing this project by under your proposal as opposed to what it would be if you were just bringing gas down as proposed by the ANGTS group, and I recognize this is a qualification now. I assume that in each case, you are bringing it as far as Fairbanks anyway.

Can you elaborate a little bit more on how significant this cost reduction is because I think it has some germaneness to the economics of one project to another?

Mr. Cox. Mr. Chairman, let me address that in two ways.

First, let me address the question of raising the pressure in the pipeline for a dense phase flow. One effect that that has is reducing the diameter of the pipeline. The amount of steel that goes into it is virtually the same; the construction cost is reduced somewhat because of the smaller diameter, so there is some saving in the pipeline, although virtually the pipeline itself is the same cost as the larger diameter line operated at a lower pressure.

The savings on the treatment facilities including liquefaction would come about by virtue of the fact that construction would not have to take place on the North Slope, but could take place in a more hospitable environment at tidewater.

The cost of that construction we have estimated could be on the order of 50 percent of what it is on the North Slope.

Senator Murkowski. Thank you.

Mr. Thomas, on the matter of FERC jurisdiction, something I think you brought up in your comments; is it your contention that FERC does not have jurisdiction in this regard?

And for what reason is your conclusion that FERC does not have jurisdiction?

Mr. Thomas. We are going to claim that they do not have jurisdiction by virtue of the fact that it is an intrastate line, and we are in the beginning process of carrying on conversations with FERC and with the DOE in this regard.

Senator Murkowski. It is my observation after having been around here for a few years, Federal agencies usually don't shirk responsibility.

Mr. Thomas. FERC recently has handed down a disclaimer, I am not sure that is the right word, but let me use it, with respect to the Phillips facilities, using somewhat the same logic; and we would hope that they would be willing to broaden that just enough to take us.

Senator Murkowski. I assume you are submitting to FERC this question you have. Do you intend to address it because it seems quite germane?

Mr. Thomas. We have had preliminary conversations with them. We do not want to submit anything in writing to them and have it turned down, so we are going about it in a face-to-face conversation; but also taking it up with the Secretary of DOE, and his staff and his organization because we feel he perhaps has the power to make a ruling in that regard.

Senator MURKOWSKI. I assume at some point in time you are going to have to formalize your request and have FERC rule on it.

Mr. THOMAS. We hope not.

Senator MURKOWSKI. Well, I wish you luck.

You indicated that you proposed common line down in Fairbanks which I assume ANGTS would jointly utilize. Are your projections for the cost of that line included with ANGTS participation in it, or does your projection call for doing it alone and just making available the ANGTS—if the budget should go ahead and show—should theirs?

Mr. THOMAS. Well, the Governor's report, of course, was not predicated on a large diameter line. It was predicated on a 36-inch line all the way.

After the report was released, and I and some others became involved, we got into a conversation as to how we could make an accommodation, for ANGTS, because we didn't feel it was in the best interest of either one of us and we wanted to work out an accommodation where both of us could live in the right kind of atmosphere if at all possible. I feel they are competitive projects, so we came up with a concept of a common line from Prudhoe to Fairbanks, and it has been discussed with a number of various people. We asked the Arco engineers to give us an estimate of what the incremental costs would be in raising the diameter of the line to the point where it accommodates sufficient volume for both projects.

We don't really have a very accurate estimate of the cost, but it's probably somewhere between $300 and $500 million. Relative to the total cost of that facility, it's a fairly small amount.

So we would like to get ANGTS to consider joining us if we can get that far along. We don't want to make an issue out of it at the present time because we first feel we need to determine is there a market and what really is the viability of our project.

If we get to that point, we certainly intend to carry on serious discussions with them to see if they wouldn't be willing to join us in order to reduce the cost in both construction capital and operating cost to both of us, assuming the construction of both facilities.

Senator MURKOWSKI. With regard to the long-term contracts matter of Congress having to address the issue of any long-term commitments of energy outside of the United States, I assume that you have some opinion as to whether or not you could simply come in and request an export permit as opposed to the realities of Congress being involved and giving a blessing to long-term energy contract.

Is it your assumption that should you be able to prevail with your proposal and convince FERC that they do not have jurisdiction, that you could settle for an export permit, or do you feel you would have to bare your sole to Congress and get their blessing on a long-term energy contract?

Mr. THOMAS. I would hope that Congress wouldn't get into the details to the point of approving the terms and condition of the contract, but I can't answer whether or not that might occur. I can say this. I feel our country, as a matter of policy, has agreed to try to assist its allies in connection with the supply of energy to them in times of emergency, and I would hope that can be taken into consideration in any discussion of the matter of an export permit for gas in both with our country, and let's say the Japanese, because the Japanese ought to be willing in case of an emergency to share any supply of gas coming from Alaska with this country.

Senator MURKOWSKI. Do you think it is appropriate in your proposed project that Federal inspector's involvement be significant, or as a consequence of your proposal market the gas outside of the United States? Is it appropriate that the Federal inspector have an involvement?

Mr. THOMAS. We really haven't come to grips with that question at this time. I guess we can say that it's premature to concern ourselves too much about that since we have so many other front-end questions, such as the market for the gas and real overall viability of the project before we get down to that. At the right time we certainly will take that up and determine whether or not, in our judgment, through conversations with the Federal Government and others, whether or not that is in our interest or the best interest of the Government together.

Senator MURKOWSKI. Governor Hickel, it is indeed a privilege and a rare opportunity to be on the other side of the table, having served in your cabinet while the situation was reversed on several occasions, and they were always pleasant ones, but it's my turn.

I gathered from your initial comments that you feel that there is enough gas for both projects. Recognizing the testimony given by the spokesman on the ANGTS project that they need all the gas. I wonder if you could address that in general terms?

Mr. HICKEL. Mr. Chairman, the record is going to have to state there is 26 and 29 trillion cubic feet of proven reserve. If you will recall, when we put pieces of Prudhoe Bay together we said let's be conservative. I think you will remember that. So we agreed to talk about 1 billion barrels of oil. At that time the Federal Government, President Johnson specifically, raised the question whether that was an awful lot of oil. We might be upsetting the market. Well, that 1 billion barrels of oil was really 9 to 10 billion barrels. I don't think reserves of the north slope have literally been scratched. The problem is the gas is there now. It wasn't drilled for gas. It was drilled for oil, and how can you be sure, but I would think without unreasonable question of doubt, in the next 10 years that will more than double.

Mr. THOMAS. Mr. Chairman, may I make a little remark here? I considered putting the recent Sohio publicity release in the testimony wherein they have estimated that the Mukaluck formation should contain about a billion barrels of oil. Usually you don't find oil alone. You find gas associated with that oil, and if they come up with an additional billion barrels of reserve in Mukaluck, I think we are going to have some gas up there that's going to need to be handled as well.

Senator MURKOWSKI. Governor Hickel, obviously being a businessman in Alaska for many years you understand there has to be a return on the investment of the project, and we've already seen the ANGTS project delayed because of the realities associated with the marketability of gas at the price that it would have to carry in the alternative supply of the gas available on a short term basis from Canada.

Is there, in your opinion, a market now in the Far East for Alaskan gas, or does it too have to depend on changing world circumstances and the increased price of crude oil and equivalent Btu and all the other inputs that go into the realities, or do you feel that there is another alternative that might be brought to bear in view of the recent communique and energy agreement that seem to indicate that Japan should consider buying energy resources from the United States as a practical matter in relationship to the increasing deficits?

Do you feel that would dominate and dictate a ready market today as opposed to the realities of waiting until something has to happen so it can be competitive?

Mr. HICKEL. I don't think the pressure of the deficit is going to necessarily make Alaskan gas more marketable. I think we have to be competitive. I think we are. I think we've learned something, though. As you know, we pioneered it. There wasn't any LNG in Japan. I think there is a real possibility in Japan, especially Korea, of changing from one fuel to another. LNG is a very possible fuel to be substituted for other fuels for environmental reasons, for many other reasons, because they buy their oil on a Btu basis.

When that was first started it was a very difficult thing because they had to replace fuel with LNG. That turned out to be a good decision, and they've gone from 1 million tons to 17. I think that will increase further as they go just away from electrical generation and go to industrial uses of LNG. I think that will also help in Korea.

So it isn't necessarily the balance of payments would have a dramatic affect. I think it has some affect. I think the fact that we could conceivably have a long-term contract with Japan is in their interest and our interest, and I think that will have, again, some affect on the decision.

Above all, we want an opportunity to try, and if we fail, as I mentioned, it will hurt no one. I think if we try like we did in the early 1960's, I think we will succeed.

Senator MURKOWSKI. Recognizing the testimony of ANGTS, which indicates specifically that this gas will be needed at some point and time in the continental United States, and recognizing further that it very well may be mandatory that Congress give blessing to any long-term foreign gas contract that may be negotiated, one has to question whether or not the congressional attitudes will prevail towards utilization for domestic generation of gas as opposed to blessing it for foreign consumption. I wonder if you have that same conclusion?

Mr. HICKEL. I think as a practical matter, regardless of any legal opinion, or whether we have an export license, I think it will take some congressional action. More than that, I think we have to look at energy independence beyond our borders. The realinement of nations is what happened with Japan when we said we wouldn't send fuel. It didn't cause them to quit using it. They realined.

I think if we maintain this policy of just energy self-sufficiency within our borders, we won't recognize our friends 20 years from now because it's a very valid thing.

You take the economic situation in Mexico. We have the borders of Canada and Mexico. They both have gas reserves. I think it behooves us to look at using those gas reserves and taking those that are farther away like the North Slope, taking them to Tidewater and taking them to our friends in Asia. I think ultimately North Canada will see the same viewpoint, take the Tidewater and take the shortest route. When we finally look at energy as a free world resource rather than just things within our border, and then look at where we are located, Mr. Chairman, when we tried to put the private sector together after World War II we couldn't give our trees away in Seattle. We finally put an industry together with Japan. Our fishing industry was somewhat the same way, the gas likewise in the early 1960's. The reason we succeeded was no one stopped us, and we are just asking no one to stop us more than we are asking them to give us a boost.

So given the unique geographical location and climatically conditions of the country way up there, I think that, yes, it behooves Congress to look at exporting the gas.

Senator **Murkowski**. You indicated it has been said the consideration of the Y concept, so to speak, in Fairbanks is significant and unique to your project. Is it conceivable in your opinion and that of your group that it would be advantageous to cooperate, or joint venture in effect, the two proposals from your particular point of view; and obviously the testimony that has been previously given by ANGTS indicates—I think this is a correct conclusion—that if, in fact, your project were built alone, theirs would perhaps not be. I want to be fair in my recall of that statement. I assume that's correct. Some of you are jumping up and saying I was wrong.

With hat and the nod of a head or two, I would ask you does a marriage of gas from Alaska, making certain assumptions that there's enough gas, is that meaningful and does that make this whole conceivable project more economically viable, or does it detract from it to have it together as opposed to having it separate?

Mr. **Thomas**. Let me respond to that. We would not, of course, build a large diameter line from Prudhoe to Fairbanks unless we believed there was not some interest on the part of ANGTS to participate with us in that. Our concept, however, is not any kind of a marriage, but it would be to give ANGTS an option to use that line. We are trying to work out an accommodation for ANGTS so that we're not, as I indicated and as I said, at dagger points with each other because we think there is more to be gained through cooperation than there is through fighting.

So our objective is to work out an accommodation with ANGTS. We presently perceive that that problem would be in the form of an option to them to use half of the capacity in that line if and when they can put their project together.

Senator **Murkowski**. I would assume that you intend to pursue that, at least until the courting period is over one way or another?

Mr. **Thomas**. We are already pursuing it, and we intend to pursue it more diligently when we get to that point. That point would come when we have a market for the gas, and when we have determined the viability of the project a little more definitively than we have at the present time.

Senator MURKOWSKI. Does your project include the availability of the gas for distribution in Fairbanks?

Mr. THOMAS. This is a problem in the sense that we are shipping the raw gas down to Fairbanks, but there is not any reason why we cannot take a stream off of it and put it in marketable quality at that point for use in Fairbanks, and for all industrial purposes. Of course, one of the things that is attractive as far as Alaska is concerned with our project is it will permit the development of a much larger petrochemical industry down at Kenai than presently exists because we are going to—at full capacity we are going to have over 100,000 barrels a day of liquefied petroleum gas available there for all purposes.

Senator MURKOWSKI. Your particular project was proposed with Yukon Pacific at least at this stage of examination is, I gather, a cooperation, and if your project were to go ahead you would become a public corporation, or would you generate partners? Obviously, we've reviewed preliminary plans and they were very much a part of the package for ANGTS financing, and we know the various consortium groups that came into being, and we know there wasn't necessarily a great deal of willingness to guarantee to put the full faith in the credit of the corporation behind the guarantee as opposed to putting up the limited guarantees associated with whatever the ANGTS was. I am curious to know how you would propose to form your financing package under Yukon Pacific, and how you would expand that and what necessary equity would be required to take on a project of this magnitude?

Mr. THOMAS. There are three points that are significant in this regard. No. 1, as I mentioned earlier, we have indicated through our Government officials, who have been in contact with the Japanese, the Japanese participation and financing was about as important to us as their providing a significant market.

We cannot, in our judgment, change our mind, because we think that was one of the problems that ANGTS encounters, is that the projects are so big that it's very difficult to finance them complete within this country.

No. 2, we cannot make this a viable project without the cooperation—I would say participation—but certain the cooperation, and we've told them that all along. We want to be sure that we do not do anything which they think is contrary to their interest. If we do, we are likely to lose them, and we don't have them yet. We are likely to lose them before we have them on our side.

We think it is critical that we maintain, if possible, a developing relationship.

No. 3, of course, we've got Mr. Flannigan who has indicated that he thinks this is financeable from public sources. We think if we put everything together that perhaps we can get a viable package that will make this possible, but we're not leaning that hard on any one source. We do feel that participation by the Japanese, with their export credits and things of that nature, is absolutely essential.

Senator MURKOWSKI. I'm sure you won't lean on Mr. Flannigan heavily. I am sure you recall his comment.

Mr. THOMAS. We have it in writing.

Senator MURKOWSKI. Governor Hickel, I can't help but recall your initial remark with regard to the 1966 or 1967, or there abouts, gas liquefication project, and the realities as I recall and taking a look at a couple of corporations that walked off, and finally somebody had the vision to put it together, and the realities that were feasible then—1 million tons a year I guess is the figure and still at that today—and a lot of time has passed, but obviously some of the vision is associated with the risk factors of developing the resources from Alaska. I think that is due, to a large degree, by the hinderance of government, both through the assistance of promotion of government is indeed unfortunate.

I want to thank you individually and collectively for your excellent testimony. I think you have given us a very fine overview of the alternative plan for utilization of Alaska's gas resource. I thank you very much.

We have the next panel coming up, and I would like to recognize a few Alaskans in the audience, which is the purview of the Chair. We have a Senator with us, the Honorable Jan Fakes of Alaska representing Anchorage. Jan is back in the audience, and if she would stand up very briefly. We have the Honorable Bob Bettisworth from Alaska. Bob, it's nice to have you with us. We have the prominent Mayor Bob Dempsey. I don't know whether my friend Tom Kelly is still around and some other members of Governor Hickel's cabinet.

Have I overlooked any other Alaskans that haven't been previously recognized? If so, I apologize. You may stand up and be counted or forever keep your peace.

I think it is appropriate that we get down to panel five which represents the owners of the gas. For the last several hours we have been kicking around various proposals of what to do with your gas. We may have neglected to recognize that it still belongs to you as far as what happens to it. You've obviously got more than a little to say. I welcome you.

I guess it's fair to ask one question, the percentage of ownership of gas in Alaska represented by you three would be about what percent?

Mr. RESO. By all three together over 90 percent.

Senator MURKOWSKI. We are really talking to the horse here. With that, I would ask that you proceed.

STATEMENT OF STUART C. MUT, SENIOR VICE PRESIDENT, ARCO OIL & GAS CO.

Mr. MUT. I am Stuart Mut, senior vice president of ARCO Oil and Gas Co. My post is that of staff vice president of engineering and operations and that includes natural gas marketing.

As you just pointed out, Atlantic Richfield has a large stake in the natural gas resources in Alaska, and we are vitally interested in the issue of making this resource available for use, and we do appreciate the opportunity of appearing here today and presenting our views.

Now, we at Atlantic Richfield look at North Slope gas as a significant state and national asset as well as a corporate asset. This asset has been and still is waiting for a market and a transportation outlet to that market. We have been actively pursuing ways to develop this asset. To that end, we have conducted many proprietary studies and participated in many joint studies over a period of years.

We are firmly committed to the development of a market outlet for North Slope gas at the earliest possible date.

Now, to that end, Atlantic Richfield is currently an active and continuing member of the ANGTS consortium, and we are active in the technical studies to improve the designs and reduce the cost,and the financial studies directed towards developing a means for financing the project. We continue active support of the project, searching for ways to make it viable. Unfortunately, to date the project has been unable to generate the necessary sufficient credit support to attract the financing. There are marketing problems in the current energy context.

We at Atlantic Richfield continue to be optimistic that this ANGTS project will be completed. However, the timing of the project remains a major question and it's quite uncertain. Because of the timing uncertainty, and because of the number of fundamental changes having occurred in the domestic and the world energy situation in the 6 years that have passed since the ANGTS project was selected by the President, our company has again begun the work to review our earlier studies and to explore other options. These options include alternate pipelines, alternate markets, alternate transportation systems and liquid conversion.

One of the more publicized options, at least recently, is the trans-Alaska gas system. Altantic Richfield believes a system involving the TAGS concept with eventual sale of LNG in Pacific rim markets represents a concept which may be feasible and can be made compatible with the ANGTS system. We are pleased that the TAGS concept is receiving attention, and we look forward to an appropriate time when ARCO can join with other energy parties in addition to work.

Now, should that project prove to be feasible, it would be in the national interest and positive increment in the U.S. balance of trade with Japan and some other parts of the world.

In our company we do agree with the public studies which have been referred to here today. Those studies which conclude that sufficient volumes of gas will be discovered on the Alaskan North Slope and in the adjacent borders to support multiple gas-sell projects. Those studies have projected ultimate gas reserves from this area to be several times the 26 trillion cubic feet currently known to exist in the Pruhdoe Bay field.

We, Atlantic Richfield, see no conflict between the ANGTS project and the gas line to South Alaska, which may become economic at some earlier date. Indeed, as has been discussed by some of your previous witnesses, an LNG export project could benefit ANGTS by providing cost sharing possibilities, which would reduce the unit cost for both projects.

Atlantic Richfield is anxious to see some kind of a gas sales project initiated as soon as possible. The market outlet would provide a positive incentive for further gas exploration and development in Alaska.

In summary, Atlantic Richfield continues its full support of the ANGTS project, which we believe will be built. At the same time, we are studying other options and will consider supporting those options which appear to have favorable economics and earlier timing.

It appears that there will be adequate gas reserves in the Alaskan North Slope to support multiple projects. We believe that another project can be built ahead of or in conjunction with ANGTS without negatively affecting ANGTS.

We hope these remarks have been helpful to you, and we thank you for your consideration of our testimony.

[The prepared statement of Mr. Mut follows:]

STATEMENT OF S. C. MUT,
SENIOR VICE PRESIDENT, ARCO OIL AND GAS COMPANY,
BEFORE THE SUBCOMMITTEE ON ENERGY REGULATION
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
NOVEMBER 16, 1983

I am Stuart C. Mut, Senior Vice President of ARCO Oil and Gas Company for Engineering and Operations, including Natural Gas Marketing. Atlantic Richfield Company has a large stake in natural gas resources in Alaska and we are vitally interested in the issue of making this resource available for use. I appreciate the opportunity of presenting our views to the Committee today.

Atlantic Richfield recognizes North Slope gas as a significant state and national asset as well as a corporate asset. This asset has been, and still is, waiting for a market and pipeline. Atlantic Richfield has been actively pursuing ways to develop this asset and to this end has conducted many proprietary studies and participated in many joint studies during the past ten years. We are firmly committed to a development of a market outlet for North Slope gas at the earliest possible date.

Atlantic Richfield currently is an active and continuing member of the ANGTS consortium and is active in technical studies to improve design and reduce costs, and in financial studies to develop a means to finance the project. We continue active support of this project, patiently searching for ways to make it viable. Unfortunately, to date the project has been unable to generate sufficient credit support to attract financing, and there are marketing problems in the current energy context. Atlantic Richfield continues to be optimistic that this ANGTS project will be completed. However, the timing of the project remains a major question.

Because of this timing uncertainty, and because a number of fundamental changes have occurred in the domestic and world energy situation since the ANGTS project was selected by the United States government, ARCO has again begun work to review our earlier studies and explore other options. These options include alternate pipelines, alternate markets, alternate transportation systems, and liquid conversion.

One of the more publicized options is the Trans-Alaska Gas System (TAGS). Atlantic Richfield believes a system involving a pipeline to a South Alaska port where gas will be liquified for shipment to Japan, other Pacific Rim countries, and possibly the West Coast of the United States, represents a concept which may be feasible and can be compatible with ANGTS. We are pleased the concept is receiving attention and look forward to an appropriate time when ARCO may join other interested parties in additional work. Should such a project prove to be feasible, it will be in the national interest as a positive increment in the United States balance of trade with Japan and the world.

Atlantic Richfield agrees with the public studies which conclude that sufficient gas will be discovered on the Alaska North Slope and in the adjacent offshore waters to support multiple gas sales projects. Studies currently available to the public have projected ultimate gas reserves from this area to be several times the 26 trillion cubic feet currently known to exist in the Prudhoe Bay field.

Thus, Atlantic Richfield sees no conflict between the ANGTS project and a gas line to South Alaska which may become economic at some earlier time. Indeed, an LNG export project could benefit ANGTS by providing cost sharing possibilities which would reduce unit costs for both projects.

Atlantic Richfield is anxious to see some kind of gas sales project initiated as soon as possible. A market outlet would provide a positive incentive for gas exploration and development in Alaska. Also, it would have value for marginal oil operations. If a market outlet were available, the oil well gas would contribute to revenue rather than to costs, and this could be the difference between a commercial operation leading to field development and oil production, and an uneconomic operation which would wait for better days.

In summary, Atlantic Richfield continues its full support of the ANGTS project which we believe will be built. At the same time, we are studying other options and will consider supporting those options which appear to have favorable economics. It appears that there will be adequate gas reserves on the Alaskan North Slope to support multiple projects. Thus, we believe another project can be built ahead of, or in conjunction with ANGTS, without negatively affecting the ANGTS project.

Finally, we hope that our testimony has been helpful to you and we thank you for your consideration of our views during your deliberations on this very important subject.

STATEMENT OF FRANK E. MOSIER, SENIOR VICE PRESIDENT, THE STANDARD OIL CO., AND PRESIDENT, SOHIO OIL CO.

Mr. MOSIER. Mr. Chairman, we are pleased to appear in the committee hearing today.

We have no other reserves of any consequence in the Lower 48 or other places in the world. We are not at all concerned with competitive situation with regard to needed oil and gas at some later date in some market. We along with the other reserve owners perhaps have the most incentive to produce and market this gas, and we are very interested in doing so. We are a participant in the ANGTS project which has been delayed for obvious reasons that have been discussed from time to time today.

Regardless of this delay brought about by marketability concerns, future energy prices, financing issues and so forth, we believe that the ANGTS project is the best means identified to date to market the Alaskan gas. We have so testified in the past and still believe this to be the case.

We believe that the United States will need this gas by the early 1990's, and, in fact, probably considerably more gas than this if it is found and is the preferred market.

We continue to analyze alternatives with the hope that an approach might be identified to expedite the marketing of gas and we would not want to discourage anyone else from doing so. Consequently, we have analyzed the TAGS project, which is based upon Pacific rim markets. There is a wide spectrum of views with regard to the prospects for the TAGS project ranging from optimism to the view that it is a very long shot at best.

There are some very highly regarded people who regard the TAGS project with optimism, people we respect and people you've heard from today. We, however, are among those who believe that at this time it is a very long shot at best, and until the proponents provide convincing evidence to the contrary, we are not prepared to dilute our support for the ANGTS project. Thank you.

[The prepared statement of Mr. Mosier follows:]

Statement of F. E. Mosier
Before the Energy Regulation Subcommittee
of the Senate Committee
On Energy and Natural Resources
November 16, 1983

Mr. Chairman, my name is Frank Mosier. I am a Senior Vice President and a Director of The Standard Oil Company and President of Sohio Oil Company. Sohio Oil Company is responsible for the marketing and transportation of crude oil and the refining, marketing and transporting of petroleum products for Standard Oil. My responsibilities in the transportation area include Sohio's interest in the Alaska Natural Gas Transportation System (ANGTS), the Trans-Alaska Oil Pipeline, and tankers used to transport the Alaskan North Slope crude oil.

With the discovery of the Prudhoe Bay field, it became clear that reserves of North Slope oil and gas were sufficiently large to ensure their role as an important future source of energy for the United States. North Slope oil production, currently about 1.6 million barrels a day, now makes up a substantial portion of U.S. oil supply.

Significant gas reserves also exist at Prudhoe Bay and at points outside of Prudhoe Bay and extensive exploration efforts being conducted by Sohio and others on the North Slope will almost certainly result in the discovery of significant additional gas reserves in that area. However, due to the lack of a transportation system, with the exception of relatively insignificant amounts being used to support oil operations, this gas is not currently being produced.

Sohio participated in early formal studies to determine the best way to move North Slope gas to market but discontinued these efforts in 1974, the year in which Arctic Gas and El Paso made certificate filings before the Federal Power Commission. Sohio's withdrawal was based principally on the fact that we had no desire to enter the gas transmission business. Sohio's interest as a producer is to have a means available to move our gas to market, and we were satisfied that with these filings before the FPC, serious efforts were under way for construction of a transportation system.

The President selected ANGTS as the transportation project for North Slope gas in 1977, and it soon became obvious that the ANGTS sponsors needed additional financial support. To help broaden the project's base, the Department of Energy in 1980 requested that the principal Prudhoe Bay producers assist with the cost of design and engineering and Sohio, together with Arco and Exxon, have joined in this activity.

Ever since discovery of the Prudhoe field, Sohio has been conducting its own analysis of various methods of moving Alaskan gas. For example, we have examined other pipeline systems, conversion of the gas to methanol and other products, liquefaction of the gas on the North Slope and shipment of the LNG in ice-breaking tankers, submarines or airplanes, and use of the gas as fuel to generate electricity on the North Slope for movement to markets in the Lower 48. We have also examined the concept of an all-Alaska line with conversion of the gas to LNG on the south coast of Alaska as proposed some years ago by El Paso and, more recently, by the proponents of the Trans-Alaska Gas System (TAGS).

All of this work has convinced us that the physical concept employed by ANGTS of a large diameter pipeline through Alaska and Canada to the Lower 48 states is the best means to bring Alaskan gas to market.

In April 1982 ANGTS announced a delay in the project. This delay was caused by a number of factors, including reduced energy demand, uncertainties regarding future energy prices, the slowdown of economic activity, and uncertainties in the financial markets. Since that time, ANGTS has reduced the amounts of money and manpower devoted to the project and has concentrated on completing the preliminary engineering necessary to establish the bases needed for detailed design work. In addition, ANGTS personnel, as well as producer personnel, have tried to find ways to cut costs. These efforts have had some success. For example, the estimated cost of the conditioning plant has been cut by 25%, about $1 billion. Also, work has been done on the concept of tariff leveling with encouraging results, and the benefits of increased throughputs on marketability have been analyzed.

Over the last two years, Sohio has worked toward reaching definitive gas sales agreements with the two companies that have contractual negotiating rights to all of our Prudhoe Bay gas. While significant progress has been made, the agreements have yet not been completed, largely because of the uncertainty about the start-up date of the pipeline.

We believe the current oversupply of gas is a temporary situation. While it is, of course, impossible to predict when a reversal of this situation will occur, our projections indicate that without supplemental sources, such as those from Alaska, gas supply may fall short of demand sometime during the second half of this decade.

In our view, ANGTS will move forward only when enough potential investors believe that the energy market and the economic climate are such that their investment is likely to be profitable. A major indicator of such a climate would be an increase in world crude oil prices since we believe that future gas prices will relate to alternate fuel prices. We doubt that any project that might be considered in lieu of ANGTS will move forward until these same circumstances exist, and when they do occur, we believe that no alternative project will look superior to ANGTS. ANGTS is the most viable project we can see at this time, and we intend to continue working to move it forward.

With regard to financing ANGTS, Sohio has always been of the view that pure "project financing" will not be available. Financing studies conducted by ANGTS have confirmed this view, and the financial institutions involved in the studies have advised that a completion guarantee from the project owners, or other credit-worthy parties, is necessary before financing can be arranged.

It seems clear that financing of ANGTS will require that all owners of North Slope gas participate in the project in relation to their reserves. Furthermore, as Sohio testified in 1977 regarding the President's Decision and again in 1981 regarding the Waiver Package, it is our belief that even with all of the gas owners taking part, a project of this size could require Federal participation of some type.

When it became apparent that ANGTS was not moving ahead as rapidly as planned, certain concerned citizens in Alaska felt that other ways of moving and marketing Alaskan gas should be investigated. Their efforts have resulted in the TAGS proposal. TAGS involves a pipeline to carry unconditioned gas from the North

Slope to tidewater in southern Alaska where the gas would be liquefied for shipment by tanker to markets located in the Pacific Rim, primarily Japan. Early expectations of its proponents were that TAGS would require significantly less capital than ANGTS. They also felt that TAGS would involve fewer marketability problems in the short term and that there was a possibility of significant financial support from the consuming countries. Presumably, representatives of Yukon-Pacific will discuss these issues in their testimony today.

It is apparent to Sohio from preliminary engineering studies conducted by the TAGS proponents, from our own analysis and from the analyses of others that there are no significant cost differences between TAGS and ANGTS. Therefore, if there are any advantages to TAGS, they must relate to marketability and financing. There is a wide spectrum of opinion on these issues, ranging from optimism regarding the viability of TAGS to the belief that TAGS is a real long shot. Based on our own analysis and on discussions with prospective customers in Japan, Sohio agrees with those who consider TAGS a long shot. Moreover, from a national interest viewpoint, we believe that a domestic system such as ANGTS may be preferable to an export project. The U.S. is, and will continue to be, the largest market for natural gas in the free world. Many in the industry are forecasting that the U.S. may not have sufficient gas supplies to meet future requirements. If these projections are accurate, the Alaskan gas will be needed in the U.S. market.

Some have suggested that the TAGS LNG system could be combined with an overland pipeline system through Canada. Proponents of such a dual system recognize that it will cost more than a single system, but they believe that the advantages of modular construction and the flexibility to serve more than one market will offset this cost disadvantage. They also believe there will be sufficient gas reserves discovered in Northern Alaska to support a dual system. Sohio agrees that Alaska will most likely be a significant source of new gas reserves, but we believe that if the Alaskan gas is to be delivered to consumers in the Lower 48 in the most cost-effective manner, all of it should be moved through a single, expandable system.

In summary, we continue to believe that ANGTS is the best system for moving Alaskan gas to market. Sohio's interest as a producer is in getting the gas to market at an economical cost and at the earliest possible time. Therefore, we continue to assess alternatives as they are advanced, and we would encourage others to do the same. However, until we see convincing evidence that one of those alternatives is more effective than ANGTS in achieving our objective of timely, cost-effective delivery, Sohio is not prepared to dilute its support for ANGTS.

Senator **Murkowski**. Our next witness, and last witness of the panel, is Mr. Reso. We ask that you proceed.

STATEMENT OF SIDNEY J. RESO, SENIOR VICE PRESIDENT, EXXON CO., U.S.A.

Mr. **Reso**. Thank you, Mr. Chairman. We have submitted testimony and I ask that it be included in the record.

Senator **Murkowski**. It will be included in the record.

Mr. **Reso**. I would like to make a few summary comments concerning the issues before the committee. Exxon is a major owner of gas reserves at Pruhdoe Bay, and, of course, has a vital interest in developing a means of marketing this large resource as soon as possible. We have studied many alternate dispositions and we continue to study them. We have looked at marketing as methanol, marketing as LNG. We've looked at bringing the gas to tidewater and the installation of chemical facilities at tidewater. We have reached several conclusions which I might summarize right now.

The first conclusion is that the United States needs Pruhdoe Bay gas. It represents 13 percent of the Nation's proved gas reserves. We continue to consume more gas and oil than we are finding, and the nation's proved gas reserves have declined more than 30 percent in the past decade.

To the extent that Pruhdoe Bay gas is not delivered to domestic markets, those markets, for the most part, will have to be served by imported oil and gas. All of the proved gas reserves at Pruhdoe Bay are required for ANGTS project. ANGTS could not proceed with less than about 25 to 30 trillion cubic feet of gas committed to it.

Clearly there is not sufficient reserves for two projects, and any current LNG export project would be in lieu of, not in conjunction with ANGTS. There is potential for additional discoveries, as everyone has agreed today. However, no costly project can be based on yet undiscovered reserves. Gas must be found before it can be marketed. The disposition of any new discoveries will be decided based on markets available at the time of discovery and confirmation, and we surely do agree that decisions on their disposition should be made by private participants, and that those decisions should be made by those really at risk, the owners of the gas reserves. We are the ones that must really live with the realities of the market continuously after everyone else goes home.

We seriously question the overall commercial viability currently of exporting Prudhoe Bay gas as LNG to Asian markets. Such LNG would be at a severe competitive disadvantage to alternate sources, which would not be burdened with the additional cost of a multibillion dollar arctic pipeline. These competing sources will build LNG plants right at the gas fields.

As a matter of interest, our studies indicate that an LNG export project would require at least as much capital as ANGTS to deliver less gas to market. We do believe that ANGTS offers the best chance for commercially sound development of our Prudhoe Bay gas reserves. Significant progress has been made in engineering, permitting international arrangements and market investigations.

Of course timing is uncertain and controlled by the development of commercial arrangements that will assure that the gas can be marketed in competition with alternate fuels.

We are working toward such contractual arrangements, addressing that issue. We are committed to ANGTS. We have committed most of our gas contractually to companies who are participating in the project, and we plan to honor those contracts. We are working diligently to make ANGTS work. Thank you.

Senator MURKOWSKI. Thank you very much.

[The prepared statement of Mr. Reso follows:]

STATEMENT OF S. J. RESO,
SENIOR VICE PRESIDENT, EXXON COMPANY, U.S.A.,
BEFORE THE SUBCOMMITTEE ON ENERGY REGULATION,
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
NOVEMBER 16, 1983

I am Sid Reso, Senior Vice President of Exxon U.S.A. Exxon appreciates the opportunity to testify at this hearing on marketing alternatives for Alaska natural gas. Exxon owns a substantial share of the natural gas to be produced from the Prudhoe Bay Field on the North Slope of Alaska and has a vital interest in securing a means for marketing this large energy resource. We also believe that the nation will benefit from development of a pipeline system for transporting natural gas resources from the North Slope to the lower 48 states. Alaskan natural gas is an important component of the nation's future domestic energy supplies.

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Two years ago, I appeared before this Committee and testified that Exxon believes the Alaska Natural Gas Transportation System ("ANGTS") should be constructed. We have been convinced for many years that an overland pipeline from the North Slope to the contiguous United States is the best method of transporting North Slope natural gas to consumers. Through the years since the discovery of the Prudhoe Bay Field, we have repeatedly examined other alternative methods of transportation, including liquefaction of the gas and the use of tankers, and we have concluded that an overland pipeline is the most economical and efficient method for delivering the most energy to consumers. Furthermore, a pipeline system such as the ANGTS could be easily and economically expanded to transport additional gas from sources other than Prudhoe Bay on the North Slope. Significant progress has been made and continues to be made on ANGTS. Not only is a regulatory framework already in place, but the project has been proved technically feasible and much of the design and engineering work completed. For the foregoing reasons, we continue in the conviction that the ANGTS should be constructed.

ALTERNATIVES PROPOSED

Many alternatives for the transportation of Alaska gas have been considered. At the time of selection of the present project for an overland pipeline, the ANGTS, a competing project was considered under which North Slope gas would be transported by pipeline to a port on the southern coast of Alaska and there liquefied and shipped as LNG to California. Such an alternative was sponsored by El Paso Alaska Company. The Federal Power Commission (now the Federal Energy Regulatory Commission) concluded in its recommendation to the President that an overland pipeline could deliver "each unit of gas more cheaply" than the El Paso project, and that the overland ANGTS could be expanded to deliver greater volumes of gas at lower cost than would be required to expand the El Paso LNG project.

Recently, there has been publicity concerning an idea for the export of liquefied Alaskan natural gas to Japan and possibly to other nations on the shores of the Pacific Ocean. The concept put forward is for a pipeline to be constructed across Alaska from Prudhoe Bay via Fairbanks to a site on Cook Inlet, where a liquefaction plant and LNG storage and port facilities would be built. Natural gas from Prudhoe Bay could be transported to the plant, liquefied and shipped as a liquid to Japan. The idea for such an export project was first identified by the acronym, "TAGS", meaning Trans-Alaska Gas System, and is now identified with an organization called "Yukon-Pacific". I understand that representatives of Yukon-Pacific will testify before this Subcommittee concerning this alternative.

We have also heard some discussion of a "dual" transportation system which would combine the LNG export concept with the ANGTS project. Under such alternative, the ANGTS would follow the route now planned, but the capacity of the pipeline north of Fairbanks would be increased and a pipeline spur would be added from Fairbanks to a location on Cook Inlet, where a liquefaction plant and port for the export of LNG would be built. Then it would be possible for some North Slope gas to be transported through the ANGTS to the contiguous United States and some North Slope gas could be transported to the LNG plant for export.

We seriously question the commercial viability of an LNG export project, either as an alternative to or in conjunction with the ANGTS. Because of the substantial investment required to transport North Slope gas across Alaska, the LNG from such a project, when loaded on tankers in the Alaska port, would be much more investment intensive than any other LNG potentially available to the Japanese market. LNG from many other sources would not be burdened with the cost of more than 800 miles of pipeline through difficult Arctic terrain prior to being loaded on tankers for shipment to Japan. Such a pipeline would represent a multi-billion dollar additional cost and clearly LNG from Alaska would suffer a significant competitive disadvantage with LNG from other sources available to Japan.

Another alternative for marketing Prudhoe Bay gas that has been suggested is to convert the gas to methanol and transport it with oil in the existing Trans Alaska Pipeline System ("TAPS"). Such an alternative presents several problems. The conversion of Prudhoe Bay gas to methanol would be wasteful of energy; only about fifty-five percent of the energy input to the conversion plant would be saved as methanol. There are serious practical and technical problems that would have to be resolved in building and operating in the harsh Arctic environment at Prudhoe Bay the huge conversion plant that would be required. Also, we have concerns about the problems that would arise in attempting to transport methanol, in batches, through the TAPS crude oil pipeline. Finally, we are not certain how the large quantity of methanol that could be produced at Prudhoe Bay - about 526,000 barrels per day - could be marketed in the United States. There is no market for such quantity of methanol today.

Two presidents of the United States have recommended construction of the ANGTS based upon their conclusions that natural gas from the North Slope of Alaska will be needed by consumers in the United States. On two occasions, Congress has approved Presidential recommendations for the ANGTS. We believe the Presidents and Congress have been correct.

NORTH SLOPE GAS WILL BE NEEDED IN THE UNITED STATES

Although there is currently excess natural gas deliverability in the United States, proved reserves are declining. Annual new discoveries have not replaced production since Prudhoe Bay gas was booked in 1970. Domestic gas reserves in the United States have declined by 31 percent since that time. The Prudhoe Bay Field reserves alone are about 13% of the nation's gas reserves. The nation's reserves to annual production ratio is 10.8 years and would be 9.4 years excluding Prudhoe Bay gas. Our energy supply and security problems are illustrated by the continually declining reserve to production ratio for both oil and gas.

Our forecasts are that production of natural gas in the United States will begin to decline after 1985 and will continue that decline in the 1990s even assuming that the ANGTS is completed and Alaska gas is available to the contiguous United States in the early 1990s.

We also forecast that the demand for energy in the United States will grow at a rate of about 0.9% per year through the end of the century. Growing energy needs and declining natural gas production will mean that the United States will become increasingly dependent upon oil and gas imports. Our projection is consistent with that of the Energy Information Administration as reflected in its 1982 Annual Energy Outlook.

In the light of such forecast, we see a need for Alaska natural gas in the contiguous 48 states no later than the early 1990s. To the extent that Alaskan gas is not available for use in the contiguous United States, the nation will have to satisfy its energy needs via other energy sources, increasing our dependence on foreign supplies.

NORTH SLOPE GAS RESERVES WILL BE NEEDED FOR THE ANGTS

The ANGTS, as approved by Congress, is designed to transport an average daily volume in the range of 2.0-2.4 billion cubic feet of gas. By installation of intermediate compressor stations, the system capacity could be increased to an average capacity of 3.2 billion cubic feet of gas per day. The initial design was based upon estimates of the volumes of gas which can be produced and will be available for transportation from the 26 trillion cubic feet of gas at the Prudhoe Bay Field. The expanded capacity of the system, which can be provided at a relatively low cost, would be available for the transportation of natural gas from other sources on the North Slope.

Because of the large initial investment required to construct the ANGTS, it will be vital to the success of the project that it operate at full capacity or as near full capacity as possible, especially in the early stages of its operation, and that sufficient reserves are dedicated to the project to provide an adequate base for the capital committed. The greater the volume of gas through the system, the lower the unit cost of the delivered gas will be to the consumer. Conversely, if less gas is available for transportation through the system, the unit cost of transportation will be higher, and the delivered gas might be so costly that it could not be marketed. It is critical that the ANGTS transport at least 2 billion cubic feet of gas per day from the North Slope to be economically viable in the 1990's. Currently, we estimate that the Prudhoe Bay Field can provide 2 billion cubic feet of gas per day for transportation through the ANGTS for at least 20 years.

There is significant potential for additional large Alaskan gas reserves to be proved in the future. The National Petroleum Council study of U.S. Arctic oil and gas, December 1981, contains an estimate of undiscovered gas potential for the North Slope onshore and offshore. The study reflects that the high side potential of undiscovered gas in the area is 188 trillion cubic feet. The risked mean potential for undiscovered gas is 39 trillion cubic feet. Despite this large risk-adjusted potential, neither the ANGTS nor any other costly project for the transportation of North Slope gas can be based upon potential undiscovered gas reserves. If additional large reserves are discovered, disposition will be decided based on markets available at that time. Gas must be found before it can be marketed.

Two years ago, we expressed the opinion that the ANGTS would eventually be constructed because of the known and potential gas reserves on the North Slope. That is still Exxon's opinion. The question is timing for the construction and not whether the system should be constructed.

ANGTS STATUS

The major Prudhoe Bay producers, Atlantic Richfield, Exxon, and Sohio, joined with the Alaskan Northwest group of pipelines in a Cooperative Agreement in June of 1980 to participate in the design and engineering phase for the Alaska Gas Pipeline and Conditioning Plant. Considerable progress has been achieved under that Cooperative Agreement. Particularly noteworthy is the pioneering work achieved in developing pipeline design criteria to mitigate the effects of frost heave. The Office of the Federal Inspector recently acknowledged significant accomplishments in and gave conditional approval to the design criteria for mitigation of frost heave.

The design criteria for the conditioning plant has been approved by the Office of the Federal Inspector. A substantial amount of the engineering for the plant has been completed. An even greater amount of the engineering necessary for the Alaska pipeline segment has been completed.

During the past year, the ANGTS sponsors have undertaken studies to identify potential cost reductions. As a result of such studies, we believe that the cost estimate for the Alaskan segment can be reduced by almost 10%, or $1.4 billion in constant 1982 dollars. Most of the cost reduction (about $1.2 billion) will result through simplifying and reducing the size of the conditioning plant. In addition, a new process has been selected for that part of the plant which will remove carbon dioxide from the natural gas. We believe that further cost reductions can be achieved by using shorter construction schedules.

The Alaskan Northwest partnership of pipelines, which holds the conditional certificate for construction and operation of the Alaska pipeline and conditioning plant segments of the ANGTS, has obtained many of the permits and regulatory approvals necessary for the project. Alaskan Northwest has a right-of-way across Federal lands for the pipeline and a pending application for a State of Alaska lease covering a site for the conditioning plant. A final order approving the certification cost estimate for the Alaska pipeline was issued by the FERC in February of this year, and an order establishing cost passthrough procedures for shippers using the ANGTS was issued by the FERC in July of this year. Also, Alaskan Northwest has obtained approval by the Federal Inspector of most of the design criteria for the pipeline and the design criteria for the plant.

A major issue to be resolved is a demonstration that Prudhoe Bay gas when delivered through the ANGTS will be marketable in the 48 contiguous states. Assurance of marketability of the delivered gas is key to the decisions necessary for gas sales contracts, participation agreements and financing.

TIMING FOR THE ANGTS

We cannot predict when all interested parties will be prepared to proceed with the agreements and financial arrangements necessary for the construction of the Alaskan and Canadian segments of the ANGTS. Timing will depend upon resolution of the marketability question to the satisfaction of all participants. We are actively negotiating with our customers a method which we believe will be a workable solution to assure marketability of the gas delivered through the ANGTS.

It is certain, however, that the ANGTS project is farther along toward consumation than any other alternative for marketing North Slope gas now proposed. The framework of laws, international treaties, permits and regulatory procedures is in place. All of that would have to be revised or replaced for any other alternative for North Slope gas to proceed. No other alternative suggested has the degree of design and engineering which has been completed for the ANGTS. Through August of this year, the parties to the Cooperative Agreement had invested about $410 million in design and engineering of the Alaska segments of the ANGTS. Exxon's share of that expenditure has been about $78 million. Should any other alternative be pursued now, its sponsors would be beginning where the ANGTS sponsors were several years ago.

CONCLUSION

On balance, the ANGTS project is the best alternative for transporting Alaska natural gas for use by consumers in the 48 contiguous United States and is better than other alternatives we have studied, including export as LNG. That conclusion has been reached after thorough review of numerous alternatives. Other alternatives are possible, but none would be as beneficial to the participants, the governments concerned and the consumers. Any other alternative would require further laws, regulations and basic design and engineering, all of which have been achieved for the ANGTS. In fact, portions of the ANGTS in Canada and the United States are in operation transporting Alberta natural gas.

We have committed Exxon's gas reserves at Prudhoe Bay to pipelines which are participating through their affiliates as sponsors of the Alaska segments of the ANGTS. Alaskan natural gas is an important component of the nation's future energy needs, and we intend to continue to support completion of that project.

Senator MURKOWSKI. I am going to ask a few questions of you collectively, and if there is an exception, I would appreciate you responding if you don't necessarily agree. Otherwise, I will assume whomever speaks for the panel you are generally in agreement.

The first question, if as a consequence of the recently negotiated energy study with Japan, as a consequence of that, if our Government asked that you consider looking at the feasibility formally of marketing your gas in the Pacific rim, as a consequence of a suggestion that we examine the feasibility, what would be your individual or collective attitude, if any? Would you be favorable to that, or would you be unfavorable?

Mr. MUT. For ARCO we would be quite willing to participate in such an activity.

Mr. MOSIER. I'm not certain that I fully appreciate the consequences of responding in a positive sense to this, but I might say we market energy products in the Far East, and to the extent there was a practical mechanism, transportation and everything else included available, and we had uncommitted gas to sell and do so on an economic basis, I don't know why we would be reluctant to do so.

Senator MURKOWSKI. I assume your gas resource has been committed currently now?

Mr. MOSIER. We have a great deal of our gas——

Senator MURKOWSKI. I mean in Alaska.

Mr. MOSIER. In Alaska—committed to the lower 48 gas transmission company.

Mr. RESO. We have continued to study these markets and reached conclusions as I have described in my written testimony and my oral summary. I don't have any equivocation about the conclusions of those studies, we think we have reached a proper conclusion. As I said before, we have great interest in marketing the gas as one of the two largest owners of the gas.

We are directing all of our efforts toward making ANGTS successful as opposed to diverting human and financial resources to studying projects that we have concluded have questionable viability right now.

Of course we would be willing to examine any studies that someone would want to bring to us and see if they would be of any benefit to us, but we do not see that it would be to our benefit to divert resources to study any——

Senator MURKOWSKI. Let me ask this specifically——

Mr. RESO. We are always willing to share our cost studies with the governmental agencies as opposed to with competitors.

Senator MURKOWSKI. Mr. Reso, I will quote from the communique:

> The U.S. and Japan will encourage private industry in both countries to undertake how the feasibility or feasibility studies necessary to determine the extent to which Alaska natural gas can be jointly developed by the United States and Japanese interests.

My question to you, sir, will Exxon willingly participate?

Mr. RESO. I think we have already done such studies. I've heard several people in this room say that they would be happy to do so. I would be happy to share with the Government these studies that we have made.

Senator MURKOWSKI. Am I to take your answer to be a positive one, that your answer is yes?

Mr. RESO. We would be willing to share our information with the Government agencies involved. We would not be willing to sit down with competitors, of course. That would be very inappropriate to share our——

Senator MURKOWSKI. That's not the question here. The question is a specific one, and obviously you know how Government works. If the United States and Japan encourage industry groups to do prefeasibility studies as a consequence of this newly negotiated document, my question is whether or not Exxon will participate?

Mr. RESO. We will participate with the Government agencies as they request us to do so, Senator. Again, I must make sure that I'm clear in my answer, in that we do not foresee that we would be investigating markets with competitors within and without ANGTS.

Senator MURKOWSKI. I understand, and I appreciate the competitive atmosphere that you must compete in.

I would like to ask the panel from an economic point of view, and you are obviously the owners of the gas, and you have the information, how long can you continue economically reinjecting North Slope gas back into the ground?

Mr. RESO. Indefinitely.

Mr. MOSIER. I would agree with that.

Mr. MUT. Yes, sir.

Senator MURKOWSKI. Without losing the resource, or without substantially decreasing the value?

Mr. RESO. Without overlooking the problem here, without getting too technical right now, basically the additional value in oil recovery from having reinjected the gas essentially compensates for the additional cost of injecting. We really don't see that we cannot continue to reinject the gas indefinitely.

Senator MURKOWSKI. Collectively on the North Slope, in your efforts to pursue oil exploration, have you ever initiated specific exploration for gas alone?

Mr. RESO. We have initiated exploration for oil and gas in areas where we didn't know whether we were going to find oil and gas.

We have generally directed exploration and hope that we would be finding oil, not gas.

Mr. MOSIER. I would say the same thing. All of the activities we are involved with our primary target is oil.

Mr. MUT. I agree with that statement.

Senator MURKOWSKI. When you go out and explore for oil and you find gas shales and you exhaust, from a layman's knowledge from a geological nomenclature, do you examine to the best existing technology the gas reserve that's there?

Mr. RESO. Absolutely.

Senator MURKOWSKI. You know how much gas you have even though you haven't found any oil?

Mr. RESO. And I think I would like to comment on it. I think once ANGTS is built, it will enhance the development of gas reserves found in the search for oil and gas on the North Slope, and it will speed up development and make commercial smaller discoveries of gas.

Senator MURKOWSKI. Do you share Mr. Mut's enthusiasm of indeed it is quite likely that we will have enough gas for a multimarkets of gas?

Mr. RESO. I hope he's right. All I know now is we have 26 trillion feet of gas at Prudhoe Bay that is commercially developable.

Senator MURKOWSKI. I understand the current figures are about 33.

Mr. RESO. The current figure at Prudhoe Bay is 26 trillion feet of gas.

Senator MURKOWSKI. Beyond Prudhoe Bay, the areas recently drilled in the last couple of years?

Mr. RESO. I know of no sizable commercially proven gas reserve outside of Prudhoe Bay. We are spending a lot of money on the assumption that we will find a lot more oil and gas in the North Slope of Alaska. The decisions before us right now I think must be based on what gas is there, taking into account the potential, but investments can't be based on the potential. As I said before, we must find the gas before we can sell it.

Senator MURKOWSKI. Do you recall when this committee last took up the matter of the waiver package? That waiver package particularly addressed the authority of the owners of gas participating in the pipeline, or the distribution, which was a significant consideration, and it was done to assist the finances specifically. As a consequence, the owner companies were allowed to come in with what amounts to an equity participation in the project as opposed to selling the gas. I think that was a landmark in the recognition that this is indeed a significant project costwise, and without the participation of the owners it couldn't be financed. Well, that was done, and for reasons that have been brought out here there may be others. The construction of the project did not go ahead. It's obvious had the owner companies wished to go on line and underwrite it, it probably could have been financed. But obviously you would assume that the economics dictated that the timing was not correct, and as a consequence, they would go ahead. All of you indicated your continuing support of ANGTS. Some have been more enthusiastic about it than others, but that being the case, what is your collective anticipated timeframe that will dictate that the economics for the ANGTS project would indeed be favorable?

Mr. Reso. There is no guarantee on this answer, but all decisions in our forecast are based on ANGTS delivering gas that will compete in the marketplace, with competing fuels not subsidized in any way. Basically we are talking about competing with heavy fuel oil.

On that basis, of course, the decision and the forecast of timing is based on each of our forecasts of crude oil and subsequently fuel oil prices in the future. It is something we have been careful not to publicize. We shouldn't share that with our competitors.

With that caveat, I say we jointly believe in the early 1990's the United States will need the gas and all of the participants will have reached a decision early enough that gas can be marketed and the project started up in the early 1990's.

Senator Murkowski. You indicate it will be 1990 before the gas will be needed, but the lead time on construction will be 4, 5 or 6 years prior to that. You indicated, just in general terms, 1985, 1986 might prompt——

Mr. Reso. Our current forecast is it will take about 5 years to get the project done.

Senator Murkowski. If you say 1990, then I'm going to say 1985.

Mr. Reso. From the mid-1980's on I think is the time we currently forecast, again, with all the caveats. All the participants must agree, that the gas can be marketed against alternate fuels and that will prompt the participants to come forward with the financing required.

Mr. Mosier. I would only add on that that since it will require probably at least 5 years and perhaps some additional time to do some of the preliminary engineering and so forth, that it's going to take some signal in the world energy price situation, namely the world oil price situation, to turn this thing off. From what one reads and the popularly held views these days, and with OPEC countries and what they say, it's hard to believe that signal may be forthcoming before the late 1985, 1986 time frame.

We look at it in the context of some kind of a signal out there that world oil prices are, in fact, going to maintain real value through the coming rest of this decade and to the next. We may be tapping more into a year or two beyond 1990 and taking the lead times and everything into account, and taking the need for that kind of signal on energy prices. Without that, it's going to be difficult to cope with the economics of the situation in our view.

Senator Murkowski. In view of Arco's willingness to look at other alternatives, which will be dictated by the realities of where the gas can be marketed, do you feel your company alone could take its gas supply if, say, Exxon didn't want to take theirs? Is it all or nothing, or maybe one or two of you 90-percent owners that could do as you please, and the other would do as he pleased?

Mr. Mut. Mr. Reso earlier indicated that 25 to 30 trillion cubic feet would be necessary to support ANGTS. As we see it, that probably applies to the required reserves support, or support for any project, including TAGS, or some similar scheme.

So, in a sense, it's all or nothing if you are looking at only the current proved reserves. If other packages of gas of substantial size are discovered and developed, we see the possibility for having more than one project in operation.

I guess I might add it's obvious from our comments that we view the future a bit differently as between the companies here; in addition to the market conditions, the price conditions, there is the question of what will be the continued discovery rate of natural gas in the south 48 States? So each of us independently assessing those things come to somewhat different conclusions. We don't have a firm date in our mind. In my testimony I said the situation is so obscure that there's a great uncertainty as to when Alaskan gas might become viable in the south 48 market. In view of that uncertainty, we think it prudent to begin to study other possible alternatives. If a couple of years down the line an export scheme seems viable and the south 48 scheme seems still many years into the future, then we ought to be opting for an export scheme.

Senator MURKOWSKI. I assume that somehow you individually negotiated a contract for your entire supply of gas to the participants of ANGTS. In view of the fact that ANGTS was granted a franchise with no termination, or no time limitation for performance, is there, in fact, any time limitation on your contract, or can you individually or collectively terminate your contract agreement with ANGTS?

Mr. RESO. We have a contract with two companies. Those contracts include terms that will allow either one to terminate the contract. We are sticking, in good faith, with those contracts because we believe that we are backing the project having the highest probability of success in the shortest timeframe.

Mr. MOSIER. Our situation is quite similar.

Mr. MUT. As Is ours.

Senator MURKOWSKI. Do you believe the Government acted in the best interest of the private sector in marketing Alaskan gas not in one sector or another, not as domestically, or in foreign markets in the sense that they did not put a time limit on when the current franchise holder has to, in effect, market the gas, or, in effect, lose its franchise?

Mr. RESO. One comment I can make in response to that, Mr. Chairman, this is a very complicated project. It involves a massive amount of capital, very, very large investments, technological advancements, most of which have been achieved. It involves most of the interstate pipeline industry in the lower 48, it involves at least three governments and many more when you take into account some of the States in the lower 48 that will be receivers of the gas. It will take a long time in the best of circumstances, even if the market forces were clearer, where we could have crystal balls working better it would take many years to put the thing together.

We don't think it's too early right now to be working on contractual arrangements, even given the fact that our expectations are the early 1990's.

Senator MURKOWSKI. And you don't feel the Government should have necessarily put a timeframe on this franchise?

Mr. RESO. If the Government feels that time has been used up, I would assume it is within the discretion of the Government to make that decision.

Senator MURKOWSKI. It's pretty hard to get a consensus, as you know, from Government.

Mr. RESO. I think it was proper to give a very significant amount of time to the participants to put the project together. Of course, an infinite amount of time is not proper.

Senator MURKOWSKI. I am going to pursue this, but before I do I want to take the opportunity to apologize. There is a vote on and I have to go to the floor. It will take me about 7 minutes. I've got about 3 more minutes left to get over there, so I will temporarily adjourn the hearing. I hate to keep you here this late, but you know what they say about misery.

[Whereupon, a brief recess was taken.]

Senator MURKOWSKI. I'll attempt to conclude this in a few minutes gentlemen. I would like to ask a few more questions to the panel.

In your collective opinion, are there any oil fields on the North Slope that are being shut in because of the large quantities of associated gas, or does that really have anything to do with it?

Mr. RESO. Is your question of any oil field shutting because there—The answer to that is no.

Mr. MOSIER. I know of none.

Mr. MUT. I know of none.

Senator MURKOWSKI. Do you have any opinion as to the responsibility of FERC with regard to the application of domestic utilization of gas as opposed to another use of the gas being exported to the Pacific rim? There is a franchise. A franchise has been granted for this specific distribution as opposed to another use which would be the export of gas, and the question of jurisdiction of FERC is a very real issue, and I assume since you collectively have committed your gas to ANGTS, in reality thev have ruled, and have the authority over the method in which the distribution of that gas will occur in domestic markets. The interpretation with regard to utilization in other markets and FERC's application authority is the question I'm specifically interested in your opinion?

Mr. RESO. Without getting beyond my competence, because I think that's a question for regulatory attorneys, I understand that any export of gas is subject to permitting by regulatory authorities including the FERC.

Senator MURKOWSKI. Any expert?

Mr. RESO. That's my understanding. Again, I'm not an attorney.

Senator MURKOWSKI. Does anybody else have any——

Mr. MUT. I didn't know that FERC was the authority in that case. I thought it was another element of DOE.

Senator MURKOWSKI. I think it's probably more appropriate for FERC.

With regard to Exxon, you've indicated your basic continued support for ANGTS. Recognizing your extensive holdings of gas in Canada, how does ANGTS work in concert with your plans for developing and marketing of Canadian gas as well as obviously your holdings in Alaska? Does it correspond, or does it conflict?

Mr. RESO. It does not conflict in my view. Part of the ANGTS project is the Dempster lateral. The lateral, if built, would provide access for gas in the northern part of Canada where an Exxon affiliate, 70 percent owned by Exxon Corp. has significant gas reserves.

Generally we are hopeful the gas would be transported through the lateral and then through ANGTS sometime in the future.

Senator MURKOWSKI. As it stands now, that could be transmitted down without the necessity of the Alaskan gas line portion; is that not correct?

Mr. RESO. The gas that I was referring to, which is the Canadian Beaufort Sea area gas, the MacKenzie Delta area gas. There is currently no pipeline, gas pipeline, outlet for that gas.

Senator MURKOWSKI. The development of your gas in Canada would not necessitate the use of the Alaska portion?

Mr. RESO. No, not the Alaska portion.

Senator MURKOWSKI. Mr. Mut, would Arco be willing to participate if indeed it could be ascertained that the marketability of gas, other than the ANGTS project, was viable in your corporation's opinion? Would you be willing to participate financially in a parallel manner to which you have committed to ANGTS as a consequence of the waivers that were generated and approved by Congress?

Mr. MUT. If I understand the question correctly, yes. We would be willing to participate in some manner.

Senator MURKOWSKI. It's the conclusion of the Chair with regard to this particular testimony, and if I am incorrect, please bring it to my attention, in reality if whatever use of Alaska's gas occurs, it will require at least at this stage of prudent reserves the collective gas that's represented by your individual corporations as opposed to any one company going off and attempting to utilize their reserves for a specific alternative such as has been presented here by the Yukon Pacific?

Mr. MUT. I believe that's a correct statement with respect to either ANGTS or TAGS. Conceivably there are other schemes that might be sustained with a smaller package of reserves.

Senator MURKOWSKI. You indicated specifically that you felt there was reasonable likelihood that ultimately the gas supplies in Alaska could support both proposals?

Mr. MUT. Yes.

Senator MURKOWSKI. Do you agree with that, Mr. Mosier?

Mr. MOSIER. The known proven gas reserves would not, in my judgment, support more than a single project. And with all of the uncertainties associated with the world of drilling for oil and gas, we are not prepared to advance capital on the speculation that additional gas reserves might be found.

If the day comes, at some point and time, when it's demonstrated there is sufficient reserves to support more than a single project, then consideration could be given to another project. But we have no evidence today to support that.

Mr. RESO. I agree with that which Mr. Mosier said.

Senator MURKOWSKI. It's interesting to observe that gas if found as an incidental to the search for oil, and if you were out actively looking for more gas, and believed that indeed the marketability of two projects was there, whether or not you could find the gas, in your professional opinion do you think that you could find it, or you couldn't find it? You know Alaska pretty well collectively.

Mr. RESO. Mr. Chairman, we are looking for oil basically on the North Slope of Alaska right now. The gas that has been found, as you say, has been found as a result of that search for oil.

If and when ANGTS is built, that will change, because then ANGTS will provide an outlet for gas and will provoke people to then explore for gas specifically in gas prone areas, because gas, if found, can be put to market without the long time delays that would be involved if gas were found right now. It's just like the lower 48. I think it's one of the great values of ANGTS. It ties an area of great promise for gas discoveries, that is the North Slope of Alaska, to that area with great need for gas, that's the lower 48 States.

Senator MURKOWSKI. Gentlemen, I want to thank you. I think you have given a fair evaluation of your corporate commitment to the existing ANGTS project. You've recognized the merits of the Yukon Pacific project with some individual differences. I certainly respect that and think that we have reexamined the issue and made an appropriate record.

I guess I would conclude my questions by asking you specifically if you feel there is any one or more things specifically that Government can do to assist the marketing of Alaska's gas in an expeditious manner?

Mr. RESO. I don't feel inhibited from doing everything that I think proper.

Senator MURKOWSKI. I'm talking about government.

Mr. RESO. I don't feel inhibited by government in any way. I think we have the freedom we need. Everyone has the freedom they need to pursue every alternative, and I'm very happy for people to pursue every alternative that they can dream up, and the Government is not doing anything to stop that. I do not feel inhibited.

Senator MURKOWSKI. Government, in fact, has given a franchise, not to you individually, but a franchise has been granted for that gas. It's been brought out that what's a reasonable time limit on a franchise for performance and you've indicated that in fact you may need all the time that you can possibly get because of the magnitude of the project, and I certainly understand that. You operate the best in a free society where you don't have Government restrictions.

Here we, in effect, through the franchise concept, have restricted the gas to one particular market. If the gas were opened up to the first user, there's no necessary indication it would go any other way than the way you have indicated would be most likely, at least from the standpoint of Exxon, and Sohio as opposed to Arco. As a consequence, you have to wonder if, in effect, the Government is hindering the free enterprise system to market the gas by designating a specific franchise hold. Obviously there is some benefits to having a franchise too.

I wonder if you care to comment whether your project would be in jeopardy if it were just opened up to the first person who could come along and market Alaska gas in one market or another? Would it be in the ANGTS proposal or something else?

Mr. MUT. Mr. Chairman, I comment I'm not at all certain that the ANGTS legislation does, in fact, grant an exclusive franchise in all matters of disposition of that gas. I might hypothesize a situation where TAGS type proposal or some other scheme became viable and was a suitable alternate for oil and gas disposition other than ANGTS. At that time it would be necessary to have some affirmative action by the Congress to indicate that there was nothing contained in the previous legislation that would inhibit that project from going forward. I think such an action would be required to enable financing to be obtained.

Mr. MOSIER. I would only comment it's premature in our judgment to take up the issue of, let's say, opening the situation up to other alternatives other than franchise situation. When developments are such that there is something that looks—or there is a reason to believe that there is a real prospect, and a prospect with different time and economic implications, and the current restrictions as Mr. Mutt indicated would prohibit going forth. At that time it might be the appropriate time to consider it.

Senator MURKOWSKI. Let's assume for a moment that Yukon Alaska was able to secure long-term contracts and financing for their gas proposal as generally known to us in liquid form in the Pacific Rim. Would you then feel inclined to support the sale of your gas into that marketplace assuming at the same time that the market dictate for the ANGTS gas was not there? You are in business to sell gas, and it's not in my area to infringe upon it. I don't mean to imply that. I'm just curious to know, all things being equal, if they got a package and it's financeable and they are ready to go and ANGTS is still sitting there, what is your attitude going to be toward your franchise with ANGTS?

Mr. RESO. Mr. Chairman, under such a hypothetical question, all things being equal, if a market that we thought was a secure one that involved no more risk with acceptable contractual terms were developed?

Senator MURKOWSKI. That's pretty much what I said. We are talking about the same thing.

Mr. RESO. We don't have any special inclination to do any one thing out of hardness. The judgments that we have expressed today are really based on the conclusions of studies that indicate that the most probable outlet for the gas, the one that has the highest probability of being successful at the earliest possible time to bring that gas to a market that is commercially secure, where we can have the best chance of competing with alternate fuels, is through ANGTS. We don't see those same things in the export market right now.

Senator MURKOWSKI. So the answer is basically if the market were there, you are out to sell your gas?

Mr. MOSIER. If somebody came forth with a satchel full of money to build that pipeline and indicate a reasonable long-term price to pay for the gas, if we said we weren't prepared to sell it, I don't think anybody would believe us. That's really the question, whether this kind of thing is a long shot.

A credit-worthy party that really has the money, not our money, their money, and they are prepared to do this.

I might make one other observation, and that is the fact that a restriction exists which has limited consideration of transportation systems to ANGTS doesn't appear to have inhibited a great number of parties from bringing forth alternatives on a regular basis. We look at them, and I think the world at large looks them because there is an enormous resource base there and everybody has more less the conviction that some day we are going to find a way to get that gas to market.

Senator MURKOWSKI. I think it's fair to conclude that the market usually will dictate when and where the gas will go. With that profound observation, I would thank you for your excellent communication, and again advise you that the record will be open for 30 days and wish you well.

We have another witness, Mr. George Lawrence, president of the American Gas Association, and I understand that there are others that would like to testify briefly, and they may do so by indicating their willingness to come up to the table.

For those of you who might be wondering what the Senator's schedule is; it is being extended indefinitely. I'm not going anywhere.

I don't see anybody coming up. I will reserve the option until these fellows that are trying to decide whether to come up or not decide.

OK, we have three chairs filled.

We will hear from George Lawrence, president of the American Gas Association.

STATEMENT OF GEORGE H. LAWRENCE, PRESIDENT, AMERICAN GAS ASSOCIATION

Mr. LAWRENCE. I am George Lawrence of American Gas Association. I do have a prepared statement which I will ask be incorporated in the record, and I will give you just a few brief points in support of our strong support of the ANGTS project, just as we supported the enabling legislation for it in the latter 1970's, and as we supported the enabling legislation for the oil pipeline in the early 1970's.

We think this a result of the sound national energy policy, or AGA supplied projections to the year 2000 project a range between 17 and 27 trillion cubic feet of gas supply in the year 2000. That compares with about 19 trillion that we are using today.

We have a demand projection in the range of 19 to 31 trillion cubic feet. That's out of a reduced demand for oil energies between 85 and 100 trillion cubic feet. We expect the possibility of our market share rising from the present 27 percent level to as much as 33 percent in that time period. Now, of the 17 to 27 trillion, eight-tenths of a trillion to 1.4 TCS is from Alaska, or about 5 percent of the total. That is based on crude reserves of 33 trillion cubic feet. That's based on 26 trillion from the North Slope, and some 7 trillion from south Alaska, but it also is a part of what we hope will be a very huge resource base. AGA is supportive of the potential gas agency which estimates a potential—and this is in addition to reserve—of some 134 trillion cubic feet. But as Mr. Reso and others have pointed out, there is certainly a distinction between the crude which anchors this project and the potential anchors—which potential means you haven't done it yet. Of this 134 trillion cubic feet, our breakdown is about 8 trillion is in the probable, 29 trillion is in the possible, the largest part of it in the speculate. It is a huge resource base.

Part of our interest in this project, Mr. Chairman, is the continued reliable relationship with our neighbor to the north. In this same projection we have between 1½ and 2.4 trillion cubic feet, or about 10 percent of the total is imports from Canada. I would point out that one of the underlying points that needs to be stressed here is the fact this million-mile transmission and distribution system in the lower 48 States is pretty widely regarded as the most efficient and environmentally energy delivery system there is. It's a genuine national asset, and it's pretty well the envy of the industrialized world. We want to be sure that not only is it supplied from our business supplies, but also from our neighbors to the north and south, and certainly from the reserves and the huge potential that we see from Alaska.

I noted with interest in Mr. Jones' testimony of level of the price of $5 per million Btu in 1982 dollars, and comparing that with a comparable residual fuel oil price of $4 to $4.50, and at the moment it is our current market competition in the industrial market. But AGA has made studies that were published in the past that show as the economy improves, the price improves. I think you will find the upgrade that has gone on in the past will continue so that there will be less of it around also.

So we feel that we are always comparing gas with other prices of gas, but this $5 per million Btu is a little under $30 per barrel, and the world oil price is a bit less than that now, but I think the prospects for the late 1980's, certainly the 1990's, or in the event of a disruption in the Middle East, it could go well above that, and the price for electricity—and there are still those that would propose an all-electric economy. So we think we can compete in the marketplace.

That is not the only issue. There is national security, there's our environmental policy goals. I think as we continue to concern ourselves with our contribution to acid rain possibly, and pollution in our metropolitan areas, gas and gas in Alaska has a tremendous contribution. Our market competition isn't only in the long-term residual. We see some new market opportunities comprise natural gas vehicles which Canada is very aggressively pursuing now; the coal generation using gas for on-site electric generation and using the select use of gas with coal can improve its environmental acceptability and use our vast coal supplies; combined cycle which is being used largely in Japan to generate electricity. Gas is used to run a turbine the way that steam is used to run a boiler. These new market opportunities are going to be at a higher price, so we see this gas being competitive in the market arena.

A final point, Senator. Governor Hickle, in his comments, mentioned a quote of mine, that we thought our gas supply problems were behind us and that's a good quote. We have to convey that message particularly to Members of Congress, your colleagues in the Senate, those in the House, so that we get statutory market restraints removed. The incremental pricing provision of the Natural Gas Policy Act can make it more difficult for us to compete in the industrial market, and the Fuel Use Act which makes it illegal for us to sell gas in a large share of the industrial market. This needs to be removed.

This is AGA's view that are supply aren behind us. If they are not solved at the moment, we certainly consider them solvable unless—and I made this same testimony in this room earlier this year—unless we do some things. One would be to impose price control in our future drilling. Another would be to burn some bridges with our trading partners to the north or south. Certainly another would be to give short shread to the long-term, highly capital intensive long-lead time major supplemental supply projects of which ANGTS is certainly one.

On the AGA long-term supply optimism, that's not my opinion. I'm just the narrator for this supply projection put out by a large segments of the experts in the fall of 1980 and updated 2 years later, and it does indeed project an optimistic supply outlook, and ANGTS is a very key part of it. Thank you.

[The prepared statement of Mr. Lawrence follows:]

TESTIMONY OF
GEORGE H. LAWRENCE, PRESIDENT
OF THE
AMERICAN GAS ASSOCIATION
BEFORE THE
SUBCOMMITTEE ON ENERGY REGULATION
OF THE
SENATE ENERGY AND NATURAL RESOURCES COMMITTEE
ON THE MARKETING OF ALASKAN GAS
November 16, 1983

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Introduction

Mr. Chairman and Members of the Committee:

I am George H. Lawrence, President of the American Gas Association. A.G.A. is composed of nearly 300 natural gas distribution and transmission companies, serving over 160 million consumers in all 50 states. On behalf of these companies, I am pleased to reaffirm our support for the Alaska Natural Gas Transportation System. This project is vital for the nation's long-term energy future for three reasons:

- The energy potential of Alaska is enormous, particularly on the North Slope and in the Arctic. The best way to bring this resource to U.S. gas consumers is through the ANGTS pipeline.

- U.S. consumers will need Alaskan gas. All analysts predict that conventional gas resources will decline in the lower 48 states. As conventional gas resources decline, ANGTS gas becomes more and more of an energy bargain.

- The well publicized "gas bubble" is a temporary phenomenon. Since it will take time to complete the massive ANGTS system, today's deliverability surplus will not affect the marketability of Alaskan pipeline gas.

The Gas Energy Potential of Alaska Is Enormous

The Potential Gas Committee is an adjunct of the Colorado School of Mines. That Committee gives the following estimate of Alaskan gas:

TABLE V-1
ALASKAN GAS RESOURCES[1]
(in Tcf)

Potential	Onshore[2]	Offshore[3]	Total
Probable	6	2	8
Possible	16	13	29
Speculative	28	69	97
Proved Reserves	—	—	33
Total Resource Potential	—	—	167

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[1] Sources: Potential Gas Committee, Potential Supply of Natural Gas in the United States as of December 31, 1982. Golden, Colorado. Potential Gas Agency, Colorado School of Mines, 1983, and the 1981 statistics from EIA, U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves, 1981 Annual Report.

[2] Onshore drilling depth to 30,000 feet.

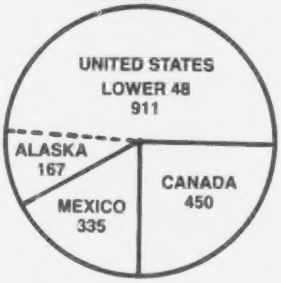
[3] Offshore water depth to 1,000 meters.

The relative size of Alaska's gas resources can be understood when we say that proven Alaskan gas reserves are 15% of proven lower 48 reserves. The following pie chart graphically compares Alaska's gas potential with other parts of North America:

FIGURE V-1

REMAINING RECOVERABLE
NATURAL GAS
IN NORTH AMERICA

1863 Tcf



Thus, we see that Alaska has a potentially bountiful, and very important, gas resource.

Two major transportation systems are planned to deliver this enormous resource to lower 48 state markets: the Pacific Alaska LNG project; and ANGTS. The Pac Alaska project is sponsored by two major California gas companies and is designed to bring LNG from Cook Inlet to the large California gas market. ANGTS, of course, is designed to tap North Slope reserves and would be constructed so that the gas is deliverable to every corner of the continental U.S. These two systems maximize the deliverability of Alaskan gas.

We understand that a competing plan to export Alaskan gas to neighboring nations in the Pacific has been put forth. Although A.G.A. continues to be a strong advocate of a global LNG trade, we do not believe that an export project should supplant the Alaskan pipeline. It is just not true that, in case of need, LNG exports from the North Slope could be shifted from Japan, for example, to the California LNG terminal. That terminal would already be taking South Slope gas, thus, we would see North Slope Alaskan gas displacing South Slope Alaskan gas. This would not increase Alaskan gas production nor would it increase overall Alaskan gas usage in the lower 48 states. ANGTS, on the other hand, will maximize our domestic energy resources, because it can deliver North Slope, Arctic, and even Canadian gas from the remote Mackenzie Delta to every state except Hawaii.

U.S. Consumers Will Need Alaskan Gas

In addition to the Potential Gas Committee, A.G.A. has its own Gas Supply Committee, which is made up of noted gas industry representatives. The Gas Supply Committee analyzed data from various sources, including the Gas Research Institute's Hydrocarbon Model, the Department of Energy, and A.G.A.'s own computer model, called TERA. Using this information the Committee developed a range of supply forecasts based on various sources of gas. The range covers three different cases: (1) a national policy to maximize domestic energy resources and to reduce foreign imports; (2) a high world oil price that allows gas prices and production incentives to rise commensurately; and (3) a low world oil price that facilitates oil imports and restrains gas production incentives. Using these three cases, our best gas supply forecast looks like this:

TABLE X-1

PRODUCTION POTENTIAL OF NATURAL GAS SUPPLY SOURCES

(in Tcf)

	Actual Production 1982	1990	2000
Conventional Lower-48[1]	17.6	17.0 -20.0[10]	12.0 -16.0
Incremental Tight Formations[2]	—	0.3 - 1.0	0.3 - 3.0
Alaska[3]	—	—	0.8 - 1.4
Canada[4]	0.8	0.8 - 1.8	1.0 - 2.4
Mexico[5]	0.1	0.1 - 1.0	0.1 - 1.5
LNG[6]	0.1	0.2 - 0.6	0.2 - 1.0
Coal Gasification[7]	—	0.1 - 0.3	0.3 - 1.5
SNG[8]	0.1	0.1 - 0.2	0.1 - 0.2
Nonconventional[9]	—	0.03-0.08	0.2 - 0.6

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[1] Adapted from gas industry and government estimates.

[2] This category is the incremental production from tight sands and Devonian shale. Volumes depend on price incentives for gas and success of new technologies.

[3] Includes pipeline deliveries from Prudhoe Bay and LNG deliveries from southern Alaska.

[4] Volumes are dependent on Canadian National Energy Board (NEB) export policies.

[5] Volumes are dependent on PEMEX export policies.

[6] Based on utilization of currently built facilities with some minor additional construction.

[7] U.S. encouragement/support of proposed programs.

[8] Synthetic natural gas made from naphtha or natural gas liquids in existing plants.

[9] Includes gas from coal seams, *in situ* coal gasification, peat and oil shale gasification, geopressured gas, gas from biomass and waste conversion. Volumes depend on the level of technology development.

[10] Achievable with special exploration and drilling incentives.

TABLE IV-4
LOWER-48 PRODUCTION ESTIMATES
(Tcf/year)

Source	1985	1990	2000	Comments
I. Major Producing Companies				
Shell	—	14.5	10.4	from *National Energy Outlook to the Year 2000*: assumes "moderately rising energy prices," July, 1982
Standard Oil of California	18.8	17.7	15.7	from *World Energy Outlook*, May 1981 and June 1982, and personal communication
Major Producer A	17.7	17.3	—	assumes little or no real growth in oil prices until 1992; includes non-conventional of 0.3 and 0.6 in 1985 and 1990, respectively. January, 1983
Major Producer B	18.4	17.4	16.2	assumes high oil price rise; includes 0.1, 0.6 and 3.1 Tcf of unconventional gas in 1985, 1990 and 2000, respectively. January, 1983
Conoco	—	16.5	13.3	from *World Energy Outlook through 2000*; increased imports of 2.5 Tcf by 1990 subtracted from published estimates. January 1982
Major Producer C	18.0	17.2	15.1	assumes little growth in crude oil prices; includes unconventional and S. Alaska. January, 1983
II. Regulated Gas Industry				
GRI Hydrocarbon Model	20.0	18.5	11-12**	Low Oil Price Scenario*
	20.6	19.7	12.6	High Oil Price Scenario*
	21.4	21.4	14.9	Self Sufficiency Scenario*
Tennessee Gas	18.0	15.4	11.9	from *Energy 1982-2000*, August 1982; requires about 225 Tcf of new reserves be added by 2000 in the lower-48. Production estimates include tight formations.
TERA (A.G.A. Model)	21.1	18.4	11.4	Low Oil Price Scenario*
	21.3	18.5	12.9	High Oil Price Scenario*
	21.4	20.4	16.1	Self Sufficiency Scenario*
III. Government Agencies and Others				
U.S. Department of Commerce	—	—	12.8	from "U.S. Energy for the Rest of the Century," Joseph F. Gustaferro, Office of Economic Affairs, reported as "domestic" natural gas. July 1982.
NEPP III	17.0	16.0	13.1	adapted from "midrange" estimates. July, 1981
Pace	18.0	17.0	16.0	"The Natural Gas Industry: Implications for the Future," speech by Thomas J. Manning, The Pace Company, GRI 3rd Annual Energy Seminar, Keystone, Colorado, August 23-25, 1982.
NGSA	17.4-18.5	—	—	assumes moderate increase in drilling, 1982 estimate
International Energy Agency	16.5-18.0	14-17	11-15	*World Energy Outlook*, 1982, includes unconventional.
EIA	14.9	16.1	—	from EIA "1982 Annual Energy Outlook," Middle World Oil Price, Table A.7.1, April, 1983
DRI	—	15.9	—	from EIA "1981 Annual Report to Congress," originally from *Energy Review*, Winter 1981-1982, Data Resources, Inc.
GAO	18.3	—	—	from General Accounting Office analysis of Natural Gas Decontrol Plan (S-615), B-211402, April 11, 1983.
DOE				"Supplemental Analysis of Natural Gas Consumer Regulatory Reform Legislation," U.S. Department of Energy, May 6, 1983.
Low Oil Price	16.9	14.3	—	
High Oil Price	16.9	14.9	—	
Merrill Lynch	18.5	17.9	—	from *Long-Term Energy Outlook: 1982-1992*, reported as "marketed production," February, 1983
Rotan Mosle	17.6	14.2	—	from *Oil and Gas Investor*, Vol. 2, No. 4, November, 1982.

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*See Section X. Estimates as of March, 1983.

**Adjusted "off line" from GRI Hydrocarbon Model run.

There are two lessons to be learned from this chart: first, Alaskan gas is necessary to meet demand after 1990; and second, conventional lower 48 production declines after 1990. Nearly all forecasters predict such a decline.

We believe that it is clear that the U.S. will have to turn to Alaska if we are to meet all of our energy needs in the year 2000. The best system to deliver this gas remains ANGTS. Furthermore, Alaskan gas is important to national security. Natural gas can replace foreign oil quickly in the event of another supply disruption. The Alaskan pipeline could offset nearly 400,000 barrels of oil per day for the next 25 to 30 years. Additional planned compressor capacity could enable the pipeline to deliver enough gas to replace about 600,000 bbl/day.

The difference that Alaskan gas could make in our balance of payments is dramatic. Domestic Alasakan gas could keep as much as $8 billion (constant 1983 dollars) from flowing out of the country in the year 2000 (over twice this amount in inflated dollars). Over the life of the system, well in excess of $100 billion in foreign oil payments (constant 1983 dollars) can be saved. The United States cannot afford to ignore this energy resource when we continue to import between 4 and 5 million barrels of oil every day at great cost to our balance of payments and our energy security.

Alaskan Gas Can Be Marketable When the Pipeline Is Completed

I know that Vern Jones' testimony on behalf of Northwest Energy discussed ways to "levelize" transportation costs to bring down burner tip prices in the first years of operation. Because we agree that the price of Alaskan gas can be competitive, we want to stress that there will be a market for new sources of gas in the 1990s.

Presently, we have a well publicized "gas bubble" -- which some even call a "glut" -- because of low demand. Demand is down because of the recent recession, conservation, and low residual oil prices. These three factors combined with an abnormally warm winter to produce excess gas deliverability now estimated at 3 Tcf, and 4 Tcf if Canadian imports are considered. It will take time to draw down, or use up, the surplus. Nevertheless, we believe that surplus deliverability is clearly a short term phenomenon which will disappear by the time ANGTS gas is delivered.

We should consider the demand for Alaskan gas in light of the conditions that are likely to exist when the gas comes to U.S. markets. Our forecast looks like this:

TABLE 1

OUTLOOK FOR GAS DEMAND BY SECTOR

(in Tcf)

	Actual 1980	Year 2000 Range
Residential	5.1	4.7– 6.0
Commercial	2.4	3.2– 4.7
Industrial	8.5	8.2–12.3
Electric Generation	3.8	1.1– 2.0
New Markets	—	1.6– 4.9
Pipeline Fuel	0.6	0.5– 0.7
Total	20.4	19.3–30.6

Although our range (from 19.3 Tcf to 30.6 Tcf) is wide, even the low end shows that Alaskan gas will be needed when demand is compared with our predictions of conventional 48 state production in the year 2000. Incidentally, our predictions do not assume that Congress repeals the Fuel Use Act and incremental pricing, even though these provisions unnecessarily distort energy markets and increase oil imports. The repeal of these demand restraints is one of A.G.A.'s prime policy objectives.

Summary

Even though it is easy to judge the future by the present, it would be unrealistic to assume that surplus deliverability is more than a short term phenomenon. Judging ANGTS by our best supply and demand projections, the project is the best way to move needed gas resources from Alaska to lower 48 state consumers. This pipeline project will not only enable us to open up other frontier areas in Alaska, but can be used to tap isolated Canadian resources as well. Plans to build a competing pipeline and an LNG export terminal do not compare with ANGTS when we consider the needs of our domestic gas market.

Thank you for the opportunity to appear before you today. If you have any questions, I would be pleased to answer them.

Senator MURKOWSKI. You commented about the gas problems being behind us. After being involved in some 30-some markups on gas deregulations, you never come to that conclusion when you are sitting on this committee.

Mr. LAWRENCE. I was testifying on some of that testimony also, Mr. Chairman, and I think once we get the gas-pricing legislation behind us and get on with the business of exploring and developing and marketing what we do find, we think there won't be quite some much rhetoric in that arena.

Senator MURKOWSKI. I would certainly hope so, but it's my observation that the industry reached as a whole is less than found collectively in the legislation presently pending. I believe your particular American Gas Association is not for immediate and complete decontrol of gas? Excluded from that is old gas.

Mr. LAWRENCE. We have always been long-standing proponents for deregulating new gas for the future.

Senator MURKOWSKI. That's part of our problem. We can't get a consensus from all the industry group.

Mr. LAWRENCE. There is lacking of unanimity, and we're wrestling with it all the time.

Senator MURKOWSKI. You can't get a compromise that is going to satisfy everybody unless you put everybody in the room and not let them out, and they come up with something they collectively support, and that wasn't done.

Do you feel in your organization that you are bound by anything that America's energy resources should be for America first, or do you think the common free market should dictate where America's energy resources go?

Mr. LAWRENCE. No; we haven't particularly focused on America first, as a matter of fact. We are part of the 42 nation International Gas Union, and we are gratified with the approved attention that the gas development utilization is getting around the world. We think to the extent that that's done, there will be less reliance on unfavorable oil supplies. So we are very supportive of the worldwide gas economy. We think this particular approved reserve, and certainly a large share of the ultimate contention is going to be needed, and is going to be an important part of our own system.

Senator MURKOWSKI. Recognizing the generality that gas follows oils to a large degree, and the significance of Japan's dependence on about 70 percent of the oil supplies coming through the Straits of Hormuz, Korea about 80 percent of the gas market for our Asian neighbors are not being fulfilled by the American gas industry. Of course, this follows with the American oil industry, but with a different set of circumstances. One wonders why America has not been more competitive in the world market potentially. Is there government restriction? Why aren't we out there in the world market for oil and gas? Why aren't we able to compete with Indonesia? Maybe we are. The facts remain, we're not exporting much gas, are we?

Mr. LAWRENCE. No, we're not.

Senator MURKOWSKI. My question to you is why?

Mr. LAWRENCE. We are just now getting into an area where we are beginning to find our wings.

Senator **Murkowski**. Why do underdeveloped countries find their wings so fast?

Mr. **Lawrence**. We are the largest gas consumer in the world, and as a result of Federal fuel price controls for 30 years, we've managed to work ourselves into a shortage and it became very severe in the mid 1970's.

Senator **Murkowski**. You are critical of government regulation?

Mr. **Lawrence**. We want the field price control brought back.

Senator **Murkowski**. If you had that offered back, to you think you would be able to export in the free market?

Mr. **Lawrence**. I don't know, but I do know we need what we see in the way of crude reserves, and also some Canadian and Mexican imports to meet some of our demand projections that we see here in the United States.

Our projections don't see us as an exporting nation of natural gas.

Senator **Murkowski**. Do you see it in the sense of reducing transportation cost, because there is only so much gas in the world, and if you reduce where you are going to send it distancewise, all you are doing is taking advantage of more favorable transportation efficiencies which are increased profits to your membership?

Mr. **Lawrence**. I can see efficiencies in transportation on the economy scale, and I think the Alaskan project can contribute to that.

Back on one of your other comments, I think there is a considerable difference between oil and natural gas, both as to its financing, its utilization and export. I guess our projections are and our answer is that we're just in this area where we are beginning to get caught up with our own demand, and we think we are going to be out of this period where we are in a shortage and a doomsday attitude.

If some of these supply technology breakthroughs come through and we have some real demands, and who knows, maybe we can reassess our exporting potential.

Senator **Murkowski**. Projections are easy, and everybody's been wrong. I don't think anybody, any industry, has probably missed any bigger than America's energy industry.

We passed the Alaska Natural Gas Transportation Act I think in the mid 1970's, because we were forecasting a severe supply shortfall. That's not the case. Had Congress known that several years ago, I'm not so sure they would have passed it. Would you agree?

Mr. **Lawrence**. I don't know.

Senator **Murkowski**. I don't know either, but we are faced with the dilemma today, and based on the forecasts for the year 2000 or thereabouts, we had those same forecasts during the debate and discussions on the Alaska Natural Gas Transportation Act. I guess you have mixed feelings on whether the Federal Government should continue to restrict the free marketing system from, in fact, operating in this regard. We've given it and it really wasn't needed because the forecasts were wrong. Now we are making new forecasts, and I don't mean to be critical, because all you can do is do the best you can.

Mr. **Lawrence**. We certainly want the Government, or as far back as the statutory market restraints that are on the books now, and I think that's a vital part, whether there is a consensus in Congress on that. That's going to be a part of anybody's legislation and that's good.

I would just say the whole world-wide natural gas situation, there is some tremendous areas of supply of natural gas other than the United States to serve the world energy markets. In liquefied natural gas there is something like 7 trillion cubic feet a year today.

Senator **Murkowski**. Do you think your association has an obligation to the realities of trying to get some long-term energy established in the Asian countries to do something about the deficit balance of payments?

Mr. **Lawrence**. I think we have a interest in controlling the deficit and controlling the inflation, because we are a regulated industry, and one of the givens is we don't keep up with high rising inflation, so it's certainly going to be good for financial help.

Senator **Murkowski**. I'm talking about the deficit balance of payments.

Mr. **Lawrence**. I see. I don't think we have the obligation to solve that, except to make our own domestic natural gas industry healthy, utilized to the fullest so that we cut back substantially on our still very considerable oil imports.

Senator **Murkowski**. It's been indicated we have too much gas in the market now, and the prebuild section is operating at 40 percent capacity, and we are waiting for the economics to catch up.

Mr. **Lawrence**. We are waiting for the economy to recover and for demand to increase and get the statutory market restraints off so that we can move to replacing imported oil in every market we can.

Senator **Murkowski**. I want to thank you, Mr. Lawrence. You may be excused.

Our next witness is in whichever order they would care. Mr. Bill Allen. Mr. Allen, it is a pleasure to welcome you here. Mr. Bob Bettisworth, Alaska State Legislature. Mr. Bob Dempsey, Alaska Interior Resources. We look forward to your testimony. You may proceed in any order you choose.

STATEMENT OF HON. BILL ALLEN, MAYOR, FAIRBANKS NORTH STAR BOROUGH, ALASKA

Mr. **Allen**. We'll testify in order of importance to this issue, that being the local government, State government, and champion of private enterprise.

Good evening, Mr. Chairman, and distinguished guests. I am Bill Allen, mayor of the second largest community in Alaska, the Fairbanks North Star Borough, a local government which is the size of the State of New Jersey and located in the interior of Alaska. I am glad to be here in the Nation's Capital to testify before this subcommittee. I only wish my luggage could join me.

There have been three primary issues of discussion today. First is the status of the gas on the North Slope, I would suggest that it is still there being used by the oil companies for power or reinjected into the ground, and this is in spite of the fact that we, in interior Alaska, have been waiting for it to move south for over 7 years.

The second issue is a review of the project proposals to utilize the gas from the North Slope. The Williams Co./Northwest Pipeline and the Yukon Pacific proposals appear to be the primary projects of emphasis to utilize and move the gas. Of particular concern to us in the Fairbanks area is not the specific preference of one of these projects over the other, but a third proposal by Alaska Interior Resource Co. to develop a methanol facility and 10 related industries in Interior Alaska.

The third is a matter of markets. I would contend that the Pacific rim countries hold the strongest potential as a major market, according to the Governor's report, and moving the gas to those markets must be pursued with all deliberate speed. However, we should pay keen attention to the needs of the markets of the United States, and as can be attested by the delays in proposals of the Northwest Pipeline, at this time the viable markets do not lie in the contiguous 48 States, but in Alaska.

The purpose of my testimony this afternoon is twofold. First, to indicate to you the substantial interest of people from interior Alaska for the development of a gas pipeline from the Prudhoe Bay fields south.

Second, and most important, is to insure that you, as committee members, and those gathered here to testify, who will be making the decisions on project proposals in the future, are aware of and familiar with the in-State gas market and related projects in Alaska. Availability of this natural resource for local consumption must be inextricably tied to any gasline option adopted. This crucial State market has been well identified by numerous resource development companies and associations in interior Alaska and other parts of the State. This market is based on the rich resource base of the State.

In agriculture, there are 31,000 square miles of land in Alaska, an area the size of South Carolina, which has the potential for being cultivated as cropland. Less than 200 miles are currently in production, but they are producing above the market average of bushels per acre and are competitive in local and export markets.

There are over 44,000 square miles of commercial forest land in Alaska, an area the size of Tennessee. This is acreage which is capable of producing 20 cubic board feet of industrial wood per acre each year. More than half of this resource is found in interior regions of the State and only a small portion of the potential is currently being produced.

Alaska has the greatest abundance of mineral resources in the United States, but is 50th in the production of minerals. There are five identified world class mineral deposits in Alaska and the potential for many more. A world class deposit will employ several hundred people, will have a potential production life of 40 to 70 years, and an impact on the world price of the particular metal. Thirty sites of major value have been indentified for the production of copper, zinc, silver, asbestos, gold, nickel, and molybdenum.

These potentials in agriculture, forestry, and mining will only remain as potentials unless a low-cost source of energy is made available to the interior of Alaska where the primary production or manufacture will occur.

And what are the general benefits of Alaskan in-State use of gas? The key issue is general economic development in Alaska and subsequent jobs for Americans. With an unemployment rate of 14 percent in interior Alaska and a significant lack of jobs in other parts of the Nation, you can understand why this concerns me. Our part of the State is rich in resources, but we are very poor when it comes to low-cost energy.

Low-cost energy is essential, if our resources are to be developed—and the availability of gas would provide such a source of energy and spur the aggressive development of environmentally safe projects in the mineral industry, forestry, industry, agricultural industry, and petroleum industry in Alaska. These particular projects will not come to fruition without gas and the low-cost source of power, it can provide. The potential for jobs is staggering if cheap power is available.

There is a very basic issue of public policy. Shall the extraction of a nonrenewable resource, such as gas, be permitted on a basis which is only constrained by what is commercially reasonable to a narrow group of interests? Or should the extraction of this nonrenewable resource take place on a basis which integrates other viable projects envisioned by nonproducers or pipeline owners? Shall there be consideration for a comprehensive set of goals rather than the limited objectives of those who would transport the gas to market?

Some have suggested that total export of the product would be most cost effective and have disregarded or taken for granted in-State use of gas. The economic expediency of ignoring in-State developers is shortsighted. A broad approach must be taken to provide local access to a portion, at least the one-eighth State royalty, of that gas for other resource development projects. Benefits of promoting diversified development would be of a greater value to government, industry, business, and consumer interests than the maximization of profits occurring from a complete exportation of the gas by pipeline owners. We contend that the economic benefits which would accrue from in-State use must be given considerable weight in these and future deliberations.

If allowances are not made for this in-State use of gas, then the thousands of jobs that could have been created by the gasline will be exported to other nations and I ask you—does this make sense?

One might argue that there are benefits from exporting all the gas found at Prudhoe Bay because it will offset our balance of trade deficit. However, looking at the big picture, the initial loss of a relatively small percentage of that gas to develop our Alaskan industries will be far outweighed by the increased level of future mineral, timber, and agriculture exports. All of the Alaskan resources I have mentioned have significant potential for inclusion in export markets. The long-term benefits for American business and tremendous export possibilities for these industries can have an astounding and positive impact on the economic viability of the State and Nation. The planning of a gasline project must provide ample consideration for low-cost energy and use of gas for environmentally sound value-added enterprises.

I hope that I have adequately impressed upon you the dire need which the citizens of interior Alaska have for the construction of a gasline project and its importance to the region. Again, I would like to stress the importance of adequate access for the in-state use of this natural resource.

Additionally, Senator Murkowski, I firmly believe that reasonable maturity dates must be placed on the current franchise agreement with Northwest Pipeline. Otherwise, deadlines absent natural gas to my community could be solely of the convenience of the franchisee.

Senator, thank you very much. This hearing has been very informative and interesting, and I appreciate your holding same and allowing me the opportunity to participate.

[The prepared statement of Mr. Allen follows:]

TESTIMONY

BY FAIRBANKS NORTH STAR BOROUGH MAYOR, BILL ALLEN
BEFORE THE
ENERGY REGULATION SUBCOMMITTEE
ENERGY AND NATURAL RESOURCES COMMITTEE
UNITED STATES SENATE
SENATOR FRANK MURKOWSKI, CHAIRMAN
WASHINGTON D.C.
NOVEMBER 16, 1983

GOOD AFTERNOON, MR. CHAIRMAN, SENATORS, AND DISTINGUISHED GUESTS. I AM BILL ALLEN, MAYOR OF THE SECOND LARGEST COMMUNITY IN ALASKA, THE FAIRBANKS NORTH STAR BOROUGH, A LOCAL GOVERNMENT WHICH IS THE SIZE OF THE STATE OF NEW JERSEY AND LOCATED IN THE INTERIOR OF ALASKA.

THERE ARE THREE PRIMARY ISSUES OF DISCUSSION TODAY -- FIRST IS THE STATUS OF THE GAS ON THE NORTH SLOPE, I WOULD SUGGEST THAT IT IS STILL THERE BEING USED BY THE OIL COMPANIES FOR POWER OR REINJECTED INTO THE GROUND, AND THIS IS IN SPITE OF THE FACT THAT WE IN INTERIOR ALASKA HAVE BEEN WAITING FOR IT TO MOVE SOUTH FOR OVER SEVEN YEARS.

THE SECOND ISSUE IS A REVIEW OF THE PROJECT PROPOSALS TO UTILIZE THE GAS FROM THE NORTH SLOPE. THE WILLIAMS COMPANY/NORTHWEST PIPELINE AND THE YUKON PACIFIC PROPOSALS APPEAR

TO BE THE PRIMARY PROJECTS OF EMPHASIS TO UTILIZE AND MOVE THE GAS. OF PARTICULAR CONCERN TO US IN THE FAIRBANKS AREA IS NOT THE SPECIFIC PREFERENCE OF ONE OF THESE PROJECTS OVER THE OTHER, BUT A THIRD PROPOSAL BY ALASKA INTERIOR RESOURCE COMPANY TO DEVELOP A METHANOL FACILITY AND TEN RELATED INDUSTRIES IN INTERIOR ALASKA.

THE THIRD IS A MATTER OF MARKETS. I WOULD CONTEND THAT THE PACIFIC RIM COUNTRIES HOLD THE STRONGEST POTENTIAL AS THE MAJOR MARKET (SEE GOVERNORS REPORT), AND MOVING THE GAS TO THOSE MARKETS MUST BE PURSUED WITH ALL DELIBERATE SPEED. HOWEVER, WE SHOULD PAY KEEN ATTENTION TO THE NEEDS OF THE MARKETS OF THE UNITED STATES, AND AS CAN BE ATTESTED BY THE DELAYS IN THE PROPOSALS OF THE NORTHWEST PIPELINE, AT THIS TIME THE VIABLE MARKETS DO NOT LIE IN THE CONTIGUOUS 48 STATES, BUT IN ALASKA.

THE PURPOSE OF MY TESTIMONY THIS AFTERNOON IS TWOFOLD. FIRST, TO INDICATE TO YOU THE SUBSTANTIAL INTEREST OF PEOPLE FROM INTERIOR ALASKA FOR THE DEVELOPMENT OF A GAS PIPELINE FROM THE PRUDHOE BAY FIELDS SOUTH.

SECOND, AND MOST IMPORTANT, IS TO INSURE THAT YOU, AS COMMITTEE MEMBERS, AND THOSE GATHERED HERE TO TESTIFY, WHO WILL BE MAKING THE DECISIONS ON PROJECT PROPOSALS IN THE FUTURE, ARE AWARE OF AND FAMILIAR WITH THE IN-STATE GAS MARKET AND RELATED PROJECTS IN ALASKA. AVAILABILITY OF THIS NATURAL RESOURCE FOR LOCAL CONSUMPTION MUST BE INEXTRICABLY TIED TO ANY GASLINE OPTION ADOPTED. THIS CRUCIAL STATE MARKET HAS BEEN WELL IDENTIFIED BY

NUMEROUS RESOURCE DEVELOPMENT COMPANIES AND ASSOCIATIONS IN INTERIOR ALASKA AND OTHER PARTS OF THE STATE. THIS MARKET IS BASED ON THE RICH RESOURCE BASE OF THE STATE.

IN AGRICULTURE THERE ARE 31,000 SQUARE MILES OF LAND IN ALASKA, AN AREA THE SIZE OF SOUTH CAROLINA, WHICH HAS THE POTENTIAL FOR BEING CULTIVATED AS CROP LAND. LESS THAN 200 MILES ARE CURRENTLY IN PRODUCTION BUT THEY ARE PRODUCING ABOVE THE MARKET AVERAGE OF BUSHELS PER ACRE AND ARE COMPETITIVE IN LOCAL AND EXPORT MARKETS.

THERE ARE OVER 44,000 SQUARE MILES OF COMMERCIAL FOREST LAND IN ALASKA, AN AREA THE SIZE OF TENNESSEE. THIS IS ACREAGE WHICH IS CAPABLE OF PRODUCING 20 CUBIC BOARD FEET OF INDUSTRIAL WOOD PER ACRE EACH YEAR. MORE THAN HALF OF THIS RESOURCE IS FOUND IN INTERIOR REGIONS OF THE STATE AND ONLY A SMALL PORTION OF THE POTENTIAL IS CURRENTLY BEING PRODUCED.

ALASKA HAS THE GREATEST ABUNDANCE OF MINERAL RESOURCES IN THE UNITED STATES BUT IS 50TH IN THE PRODUCTION OF MINERALS. THERE ARE FIVE IDENTIFIED WORLD CLASS MINERAL DEPOSITS IN ALASKA AND THE POTENTIAL FOR MANY MORE. A WORLD CLASS DEPOSIT WILL EMPLOY SEVERAL HUNDRED PEOPLE, WILL HAVE A POTENTIAL PRODUCTION LIFE OF 40 TO 70 YEARS, AND AN IMPACT ON THE WORLD PRICE OF THE PARTICULAR METAL. THIRTY SITES OF MAJOR VALUE HAVE BEEN IDENTIFIED FOR THE PRODUCTION OF COPPER, ZINC, SILVER, ASBESTOS, GOLD, NICKEL, AND MOLYBDENUM.

THESE POTENTIALS IN AGRICULTURE, FORESTRY AND MINING WILL ONLY REMAIN AS POTENTIALS UNLESS A LOW COST SOURCE OF ENERGY IS MADE AVAILABLE TO THE INTERIOR OF ALASKA WHERE THE PRIMARY PRODUCTION OR MANUFACTURE WILL OCCUR.

AND WHAT ARE THE GENERAL BENEFITS OF ALASKAN IN-STATE USE OF GAS? THE KEY ISSUE IS GENERAL ECONOMIC DEVELOPMENT IN ALASKA AND SUBSEQUENT JOBS FOR AMERICANS. WITH AN UNEMPLOYMENT RATE OF 14% IN INTERIOR ALASKA AND A SIGNIFICANT LACK OF JOBS IN OTHER PARTS OF THE NATION, YOU CAN UNDERSTAND WHY THIS CONCERNS ME. OUR PART OF THE STATE IS RICH IN RESOURCES BUT WE ARE VERY POOR WHEN IT COMES TO LOW COST ENERGY.

LOW COST ENERGY IS ESSENTIAL IF OUR RESOURCES ARE TO BE DEVELOPED -- AND THE AVAILABILITY OF GAS WOULD PROVIDE SUCH A SOURCE OF ENERGY AND SPUR THE AGGRESSIVE DEVELOPMENT OF ENVIRONMENTALLY SAFE PROJECTS IN THE MINERAL INDUSTRY, FORESTRY INDUSTRY, AGRICULTURAL INDUSTRY AND PETROLEUM INDUSTRY IN ALASKA. THESE PARTICULAR PROJECTS (E.G., ORE PRODUCTION AND PROCESSING FACILITIES, WOOD PROCESSING AND MANUFACTURING FACILITIES, GRAIN DRYING, PROCESSING, AND AGRICULTURAL GREENHOUSE FACILITIES, PETROCHEMICAL AND METHANOL PROCESSING FACILITIES) WILL NOT COME TO FRUITION WITHOUT GAS AND THE LOW COST SOURCE OF POWER IT CAN PROVIDE. THE POTENTIAL FOR JOBS IS STAGGERING IF CHEAP POWER IS AVAILABLE.

THERE IS A VERY BASIC ISSUE OF PUBLIC POLICY. SHALL THE EXTRACTION OF A NON-RENEWABLE RESOURCE SUCH AS GAS BE PERMITTED ON A BASIS WHICH IS ONLY CONSTRAINED BY WHAT IS COMMERCIALLY REASONABLE TO A NARROW GROUP OF INTERESTS? OR SHOULD THE EXTRACTION OF THIS NON-RENEWABLE RESOURCE TAKE PLACE ON A BASIS WHICH INTEGRATES OTHER VIABLE PROJECTS ENVISIONED BY NON-PRODUCERS OR PIPELINE OWNERS? SHALL THERE BE CONSIDERATION FOR A COMPREHENSIVE SET OF GOALS RATHER THAN THE LIMITED OBJECTIVES OF THOSE WHO WOULD TRANSPORT THE GAS TO MARKET?

SOME HAVE SUGGESTED THAT TOTAL EXPORT OF THE PRODUCT WOULD BE MOST COST EFFECTIVE AND HAVE DISREGARDED OR TAKEN FOR GRANTED IN-STATE USE OF GAS. THE ECONOMIC EXPEDIENCY OF IGNORING IN-STATE DEVELOPERS IS SHORTSIGHTED. A BROAD APPROACH MUST BE TAKEN TO PROVIDE LOCAL ACCESS TO A PORTION (AT LEAST THE 1/8 STATE ROYALTY) OF THAT GAS FOR OTHER RESOURCE DEVELOPMENT PROJECTS. BENEFITS OF PROMOTING DIVERSIFIED DEVELOPMENT WOULD BE OF A GREATER VALUE TO GOVERNMENT, INDUSTRY, BUSINESS AND CONSUMER INTERESTS THAN THE MAXIMIZATION OF PROFITS OCCURRING FROM A COMPLETE EXPORTATION OF THE GAS BY PIPELINE OWNERS. WE CONTEND THAT THE ECONOMIC BENEFITS WHICH WOULD ACCRUE FROM IN-STATE USE OF MUST BE GIVEN CONSIDERABLE WEIGHT IN THESE AND FUTURE DELIBERATIONS.

IF ALLOWANCES ARE NOT MADE FOR THIS IN-STATE USE OF GAS THEN THE THOUSANDS OF JOBS THAT COULD HAVE BEEN CREATED BY THE GAS LINE WILL BE EXPORTED TO OTHER NATIONS AND I ASK YOU -- DOES THIS MAKE SENSE?

ONE MIGHT ARGUE THAT THERE ARE BENEFITS FROM EXPORTING ALL THE GAS FOUND AT PRUDHOE BAY BECAUSE IT WILL OFFSET OUR BALANCE OF TRADE DEFICIT. HOWEVER, LOOKING AT THE BIG PICTURE, THE INITIAL LOSS OF A RELATIVELY SMALL PERCENTAGE OF THAT GAS TO DEVELOP OUR ALASKAN INDUSTRIES WILL BE FAR OUTWEIGHED BY THE INCREASED LEVEL OF FUTURE MINERAL, TIMBER AND AGRICULTURE EXPORTS. ALL OF THE ALASKAN RESOURCES I HAVE MENTIONED HAVE SIGNIFICANT POTENTIAL FOR INCLUSION IN EXPORT MARKETS. THE LONG TERM BENEFITS FOR AMERICAN BUSINESS AND TREMENDOUS EXPORT POSSIBILITIES FOR THESE INDUSTRIES CAN HAVE AN ASTOUNDING AND POSITIVE IMPACT ON THE ECONOMIC VIABILITY OF THE STATE AND NATION. THE PLANNING OF A GASLINE PROJECT MUST PROVIDE AMPLE CONSIDERATION FOR LOW COST ENERGY AND USE OF GAS FOR ENVIRONMENTALLY SOUND VALUE-ADDED ENTERPRISES.

I HOPE THAT I HAVE ADEQUATELY IMPRESSED UPON YOU THE DIRE NEED WHICH THE CITIZENS OF INTERIOR ALASKA HAVE FOR THE CONSTRUCTION OF A GASLINE PROJECT AND ITS IMPORTANCE TO THE REGION. AGAIN, I WOULD LIKE TO STRESS THE IMPORTANCE OF ADEQUATE ACCESS FOR THE IN-STATE USE OF THIS NATURAL RESOURCE.

THANK YOU.

Senator Murkowski. Thank you. Next is Representative Bettisworth.

STATEMENT OF HON. ROBERT BETTISWORTH, ALASKA STATE LEGISLATURE

Mr. Bettisworth. I am Bob Bettisworth, State representative from District 20, Interior of Alaska. I am a vice-chairman of the House Finance Committee and also chairman of the State Legislator's Budget Audit Committee. The chairman of the Budget Audit Committee has the responsibility to oversee State revenues, the budget concerning those revenues, and that's why I've been involved and quite interested in the hydrocarbon issue in the State of Alaska and our Nation for quite some time.

Even though I don't want to try to tell anybody I'm an expert, but as a layman I have some reasonable knowledge of what's going on and what might happen and what might not and what the possibilities are, and what think some of the possibilities are not. I want to take this opportunity to particularly thank you for holding these hearings.

As you know, in Fairbanks and the Interior the gasline has been a favorite subject up there for some 10 or 12 years now, ever since the oil line got going and we were told it was just a matter of time until the gasline has to go because we can only produce this oil field for a minimum amount of time until we have to dispose of the gas.

We heard testimony today that that could be reinjected indefinitely.

I have written testimony which I want to submit.

Senator Murkowski. It will be submitted in the record as if read.

Mr. Bettisworth. With your indulgence, I will not read from my text, but would recommend that any serious student of the issue would find it most enlightening.

If I may, I would like to comment on four or five points that were raised in the testimony today.

The first I want to state as a representative, I fully support the Pacific Yukon proposal for in-State gasline with a sufficient tap for feeding the lines to serve the Interior needs and demands that we feel are there today and are feasible and viable today, and will be addressed further by Mr. Dempsey.

The reason I can strongly support that line is because I generally believe that the pipeline to the State, or ANGTS pipeline, will never be built. I would like to briefly elaborate as to why I strongly believe it will not be built, and I will do more work on substantiating these beliefs.

If we go back to signing the certificate of need for that pipeline, which is about 7 years ago, there was, in fact, a shortage of gas. There was a shortage in Canada. Supplies in the Pacific Northwest were being curtailed, and in order to get permits across Canada it was mandated Alaskan gas be available to supply Americans because of dwindling supplies.

A string of events that took place over the next 4 or 5 years was an increase in cost, an increase in demand for gas which triggered in the free marketplace an increased price. Even though gas is regulated, there are areas where it is not regulated. Increased drilling, increased activity, increased exploration did generate increased supply.

By the time the gas pipeline started looking at financing, supplies in Canada had greatly increased to where the Canadians felt for the first time in many years that they had sufficient surplus supplies for export. Pacific Northwest markets were again picked up by Canadian gas. The same thing happened in the United States. Increased prices brought on increased exploration and increased supplies, which has been to my approval. The free market, the free enterprise systems talked about were promoted and certainly advocated here extensively.

The only way that this line could be built, because we understand that the two major energy crises that this country has gone through, the one in 1973 and 1974, and again in 1979, 1980, and 1981 were the duration of only 2 or 3 years in which they took care of themselves because of the free market. We've heard testimony it will take 5 to 6 years to build this line. In the case of a crisis which would prompt the construction of the line and cause of increased prices, the prices themselves would prompt renewed exploration and discovery in the Continental United States which would supply the market, bring the demand down before that line could be built.

We all know during the second energy crisis billions of dollars were spent by the Federal Government for synfuels, oil and shale research in the name of national defense and energy independence. In my mind, that's a justified expenditure, but had those dollars been spent on the gasline, we would have the gasline, we would have the gas available in case of an emergency. We would have something to show for those dollars, and now we don't have anything to show for it.

So in the justification, if the Federal Government chooses to do so, of subsidizing that gasline, it could be, and perhaps should be, in the name of national defense and energy independence. Otherwise, the marketplace, the free enterprise system, the fact that there is lot of gas left in the Continental United States, will preclude the construction of that pipeline.

Some of you are probably familiar with Anarco Basin. It is a deep gas reserve in northwest Texas Panhandle and southwestern Oklahoma, which I've known about ever since I was a kid. It's 25,000 to 30,000 feet deep under high pressure, and with the increase in gas prices and the deregulation of in-State gas sales, that field was finally successfully tapped and brought in extremely large reserve gas into the system.

We also know that there is the same kind of deep reserves along the gulf of Louisiana and Texas. When the price is right and the demand is there it can be tapped, which is another argument for saying that this kind of gas that we know is available would preclude a 5-year lead time for building the gasline we've been talking about.

[The prepared statement of Mr. Bettisworth follows:]

STATEMENT OF HON. ROBERT BETTISWORTH, ALASKA STATE LEGISLATURE

Senator Murkowski, distinguished Senators.

I am Robert Bettisworth, a State Legislator whose immediate constituency is the Fairbanks, Alaska region.

I serve as vice-chairman of the Alaska House of Representatives Committee on Finance. I also serve as the chairman of the Legislative Budget and Audit Committee, an oversight committee that is responsible for budgeting and auditing functions for the Legislature.

In these two latter assignments, my constituency broadens statewide. I make these explanations to demonstrate to you that my perspecive on Alaskan issues goes beyond my home legislative district of Fairbanks.

We with Legislative financial assignments have serious concerns about the revenue of our State.

You are aware that more thn 90% of our current state revenues come from the Prudhoe Bay hydrocarbon developments.

If natural gas from the Sadlerochit formation, which is the single largest natural gas source in our country, is not produced, it is pumped back into the ground and is absolutely no value to the State of Alaska.

NEED GAS IN INTERIOR ALASKA

I want you to know at the outset that I support the concept of piping natural gas from Prudhoe to tidewater in southcentral Alaska, and as the gas mainline travels through Interior Alaska, I want to see a feeder line into Fairbanks.

I realize such an undertaking won't be easy and that the economies must be there. But that's why we are here today... to talk about such events!

Right now consumption of natural gas in Fairbanks and Interior Alaska would provide only a small incentive in the total overall scheme of things, but, if we EVER are going to have natural gas fuel, there has to be a starting point.

Today could be that starting point.

We need a cheaper fuel in the Interior. We need it badly. We've been "Have Nots" too long.

EQUITY IS LACKING

Those Who Have Gas

To Fairbanks' north, Prudhoe Bay has access to cheap natural gas fuel. ARCO and SOHIO use enormous quantities of natural gas in their operations. The power generating plant alone is capable of servicing a city the size of Anchorage.

In transporting more than 1.6 million barrels of crude oil per day, Alyeska Pipeline Service Company uses natural gas as its fuel in one third of its pump stations: Pump Station one at Prudhoe; Pump Two, 68 miles south from the Arctic coast; Pump Three,.about 115 miles south of Prudhoe; and, finally Pump Station Four 164 miles south of Prudhoe and very near the divide at Atigun Pass.

Then over to the westward, the Eskimos at Barrow have had cheap natural gas for their heating use for more than 20 years. They now are studying ways of converting that gas to a low volatile fuel for transport to six other villages on the North Slope of Alaska. That Barrow gas operation has been heavily subdized by Uncle Sam all these years.

Now, turn your attention south to Anchorage. Since 1960 that community has has access to cheap natural gas fuel.

As a result of the industriousness, farsightedness AND American entrepreneursip of people like Wally Hickel and Dave Teel of Enstar Natural Gas Co. (which began in 1960 as Anchorage Natural Gas Company) and others, Anchorage, Alaska now has the lowest electrial rates in the United States of America. Anchorage also has one of the very lowest fuel sources in the United States - natural gas!

This "Have Not" is Ready to Fight (for gas)

As a resident of Interior Alaska for 35 years, I have been paying high fuel costs for too many years. To the north of Fairbanks there is cheap and abundant natural gas fuel (Prudhoe and Barrow). To the south there is cheap and abundant fuel. I am prepared to fight for cheaper natural gas fuel for my area of Alaska.

A gas line that is routed south from Prudhoe would logically pass close to Fairbanks and other Interior Alaska communities. I support a trans-Alaska route. I insist that this future line have one big valve in the vicinity of Fairbanks so we can tap off cheaper fuel.

GAS EXPLORATION/DISCOVERY SCHEDULES

The 1973 oil embargo, then later the Iranian crisis, and the continued OPEC clamp on oil supplies caused world oil and gas prices to shoot up. As a result, a flurry of exploration activity occurred in the United States. More gas was discovered. Much of that gas is "easy" gas, that is, smaller fields, limited supplies, shallower depths, etc.

Right now - TODAY- we have plenty of gas in our country. And, as a result of this supply, exploration has slowed down considerably.

But that may not be the case five years from now! This current "gas bubble" may burst at any time.

Five years from now - the time it would take to build a trans-Alaska gas pipeline from Prudhoe to Valdez or Cook Inlet ....Five years from now the United States may be demanding that the Prudhoe Bay gas be produced and distributed.

TRUE VALUE OF ALASKA GAS UNKNOWN

There has never been a public sale of Prudhoe Bay gas to find out what the free market would pay for that gas.

I am pushing the Governor and the State of Alaska to put its royalty gas up for sale on a competitive bid basis to find out if there is anybody out there who wants to buy it.

I encourage the owner companies to participate in that sale to establish in the free market place, once and for all, whether or not there is a market for that gas.

I wonder - and seriously question - if our state is getting "value" for the gas that's being used now by the owners and producers at Prudhoe.

REVENUE FOR ALASKA

A long term bulk sale of North Slope natural gas to West Coast or Far East markets will mean general economic good health for Alaska. The severence taxes the State collects plus the value of the royalty gas will fill out our state treasury.

Certainly, there is no value to the State if the gas is left in the ground or if it's pumped back into the formation and left there forever.

The only beneficiaries of the gas, in those cases, are the producers who have access to this cheap fuel.

As chairman of the Budget and Audit Committee, I am required to look at our future revenues just as I am required to be concerned about our current revenues. Only irresponsible people sit by and don't take action. I feel a great responsibility to my Interior region constituents, and I think they expect me to fight for them every way I know how. Moreover, I feel a CREAT responsibility to the citizens of Alaska to get the best DOLLAR ($) return I can for their natural resources. Pumping gas back into the ground from now to eternity is not a responsible act when I see how much we in the Interior need cheaper fuel.

OTHER SPIN-OFFS

Let me tell you about the use of natural gas in the Anchorge.

In 1960 the Alaska Natural Gas Company began on a small, modest scale and one of the persons instrumental in its growth, Wally Hickel, is here today. It took some visionary people to undertake the gas issue in 1960. The negative people were there telling them that they would never successfully lay gas lines in frozen ground, or that there would never be a market for gas since oil was so cheap, or that the gas transmission line could NEVER be safely laid on the floor of the treacherous Cook Inlet (where one of the highest tides in the world flows rapidly in and out).

The company servicing Anchorage area today is the same one that began in 1960. Growth rates continue at 11 to 13% annually, according to Dave Teel, president and chief operating officer of the company. A $50 million line is being completed this winter so thousands more Alaskans in the Matunuska Valley north of Anchorage will have cheap fuel.

Methanol Plant in Fairbanks

There is proposed a methanol production facility in Fairbanks. The principals in that project have entered testimony before you today. The firm is Alaska Interior Resources Company, Inc. They would refine natural gas into methanol (methol alcohol) and use a portion of it for fuel in an industrial complex they have proposed, and they then would transport the remaining refined product to ready markets in the western United States. Before Alaska Interior Resources (AIR) can accomplish this, however, gas must be available.

Future Mineral Processing

Interior Alaska is a highly mineralized area of Alaska, but refining and processing ores is prohibitive under current circumstances. With cheap fuel, some of the dreams mining people have had may come about.

Agri Business

I am convinced that agriculture has great potential in Interior Alaska. Cheaper fuel for farming operation could make that resource a reality. And natural gas is a feedstock for feterlizer manufacturer.

HISTORY OF GAS IN NORTHERN ALASKA

Early exploratory reconnaisance (100 or so years ago) of Alaska's Arctic coast convinced explorers that there were hydrocarbons in that part of the country. Those people saw oil seeps along the coastal region west of Barrow and along the Colville River.

In the Cape Simpson region, some Eskimos chipped out chunks of brittle pitch in winter months and for decades some of them used the pitch for fuel.. That practice continued into the 1940's.

President Warren Harding declared the central North Slope a Petroleum Reserve back in the 1920's because official Washington was convinced there was value in Alaska' Arctic. During World War II a batallion of U.S. Navy Seabees was dispatched to Barrow vicinity and set up an exploration program that continued until late 1953. There was a gas find at Barrow (the Eskimo community of Barrow still uses natural gas from that South Barrow Gas Field) and another find at Umiat, 150 miles inland.

Other exploratory wells confirmed gas as well. The biggest and most promising was on the Gubik (geologic) structure which is near Umiat and East of the Colville River.

In 1954 the Alaska Development Board, a Territorial board, conducted a study on a proposed gas pipeline from Gubik to Fairbanks. That line would have been a small diameter line that would service the Fairbanks vicinity (confirmed reserves did not warrant a larger line to other remote locations like Anchorage). It was just about this time that exploration in Cook Inlet was getting very serious, and folks in Anchorage already were talking about natural gas from that region.

Fairbanks people got excited about the possibility of a cheaper fuel, and serveral plans were formulated to install the lines.
But the natural gas never came.

So here we are 29 years later and our hopes are being aroused again. This time I believe we can make it happen!

STRATEGIC VALUE OF CHEAPER (and local) FUEL

A stable supply of in-state fuel (like the Prudhoe Bay natural gas) certainly should be of interest to our military and strategic planners.

In the Interior we have four major strategic installations: Ft. Wainwright Army Post in Fairbanks; Eielson Air Force Base 26 miles south of Fairbanks; Galena Air Force Station on the Yukon where the Koyukuk River joins the Yukon; and Clear Ballistics Missle Early Warning Site (BMEWS) 80 miles southwest of Fairbanks on the Parks Highway.

I understand that accomodations have been reached between Governors Egan and Hickle (Pacific Yukon) and the ANGTS group to consider a large diameter line from Prudhoe to Fairbanks and a smaller line from Fairbanks on to Cook Inlet, thus allowing for large capacity to flow down southeast along the Alaska-Canada system if it were to be built. That accomodation would allow for (1) gas to flow to Cook Inlet for processing (liquifying?) and export, (2) gas to be available to Interior Alaska, and (3) still an ample supply to enter the proposed (but now dormant) Northwest line.

"DECISION MAKERS" ARE HERE TODAY

Today's hearing is not a decision-making session.

However, the DECISION MAKERS are well represented here: The State of Alaska administration, the Atlantic Richfield Company, Standard Oil of Ohio, EXXON, Department of Energy, Department of State, two competing pipeline firms, our Senator from Alaska and many other distinguished participants.

As a member of the Alaska Legislature, I respectfully request that body be included in future "decision sessions" and/or hearings on our valuable natural gas resource.

And as a Legislator and resident of Interior Alaska, I ask that all consideration be given to getting natural gas - a cheaper fuel - into our area. This cheaper fuel, GAS, would benefit many thousands of Alaskans who now suffer from great economic INEQUITY in our State.

Agreeing with me in the above statement are thousands of Alaskans who live in my region.

Senator Murkowski, today I give you a copy of a petition signed by more than 10,000 Interior Alaska residents who explicitly state that they support the construction of an in-state naural gas pipeline to Interior Alaska which would make gas available for residential, industrial and power use.

Thank you for allowing me to participate.

Senator MURKOWSKI. Thank you.

Mr. BETTISWORTH. I just want to briefly state that on the certificate I think it would be the responsibility of the Congress to look at just how long the certificate on the gasline should be held without a review. The gentlemen today said they felt 10 years was sufficient, but it was not clear to me in their testimony whether it was 10 years from 7 years ago when it was issued, or 10 years from today. I think it would do well for us to review that and come up with some kind of a statement.

Senator MURKOWSKI. You are suggesting we submit that as a question?

Mr. BETTISWORTH. There has been a lot of speculation as to whether or not there was any demand or sale for Alaskan gas. Mr. Hickle testified that he believes there is, and I believe there is. The people that own the certificate for the ANGTS pipeline seem to believe there is not.

I would submit that there is a simple way of resolving that. There has not been a competitive sale to Prudhoe Bay gas. I'm encouraging our Governor, the commissioner of national resources, to, within a year, submit Alaska's royalty share of that gas for sale on competitive bid basis, and I would encourage the owners of the balance of that gas to do the same, and we can resolve once and for all whether or not there is in fact a demand and a viable market for that gas.

Perhaps instead of having to have another hearing like this a year from now, we will be able to say yes there is, or there is not.

Further, I have to submit to you, Senator Murkowski, a petition with 10,000 signatures on it from the interior of Alaska stating they feel they've waited about long enough for a gasline, and would like to see one get going.

Senator MURKOWSKI. The petition signed by some 10,000 Alaskans will be submitted into the record.

[The text of the petition follows:]

Whereas, the Governor's Economic Committee on North Slope Natural Gas and the Alaska Power Authority are both preparing reports which will directly impact Interior Alaska, and

Whereas, we, the undersigned, support the construction of an in-state Natural Gas Pipeline to Interior Alaska which would make gas available for residential, industrial, and power use; request the Governor and Legislature, in conjunction with local governments and private enterprise, take appropriate action to insure that this project is started at the earliest possible date, thereby providing employment and opportunities for a diversified economy.

Senator MURKOWSKI. Mr. Bob Dempsey.

STATEMENT OF BOB DEMPSEY, EXECUTIVE VICE PRESIDENT, ALASKA INTERIOR RESOURCES CO., INC.

Mr. DEMPSEY. Thank you, Mr. Chairman. For the record, my name is Bob Dempsey. I am executive vice president of Alaska Interior Resources Co., Inc., an Alaskan corporation. The purpose of my testimony today is to bring to the attention of this committee the importance of in-State use of Prudhoe Bay natural gas, and the synergism that exists between such development and the question of a pipeline delivery system. Interior Resources was founded to participate as a member firm in the Dow-Shell study group which conducted an in-depth analysis regarding the use of North Slope natural gas and gas liquids for various energy and chemical uses within the State of Alaska. For the purpose of brevity, Mr. Chairman, results of that study can be divided into two general categories.

One, the production of certain petrochemicals and their derivatives would have to await changes in the world market before they would be feasible for production within the State.

Two, the production of methyl fuels and related energy products were determined to be feasible.

Alaska Interior Resources is the sponsor of the fuels project and the related Interior Alaska Planned Development Center, which is a integrated facility covering several resources development programs. The financial advisers to the project are First Boston Co. and Shearson American Express, and Black & Veatch is the engineering contractor.

We see the development of our project as being of a general benefit to the major larger questions of gas development on the North Slope and a pipeline delivery system.

First we have to identify the market for approximately 400 million cubic feet a day of gas and gas liquids at a site less than 450 miles from the North Slope. The potential for incremental growth in that market could be significant in the development of any otherwise marginal gas reserves that may exist outside of the Prudhoe Bay Reservoir.

No. 2, the presence of a substantial in-State user would aid in any phasing program that might be undertaken by a pipeline sponsor.

The benefits of this or in fact any resource development program should be viewed as they impact the international/national and in our case the in-State scene. For many years it was believed that the simple presence of a huge resource base was a vehicle for success. If that were the case, Senator, then there would be no need to have these hearings.

With the exception of oil presently flowing through the Trans-Alaska Pipeline system and the development of a coal contract with the nation of South Korea. The vast amount of Alaskan resources continue to remain untapped. They do so because of the market and logistic constraints. No one would argue the need for the United States to continue to expand her role in the export economy of the world.

The two projects for transporting Alaska North Slope gas that have been presented to you accomplish a portion of this task in very different means. One would place LNG into the Pacific rim as a means of addressing a negative trade balance. The other would reduce by several hundreds of thousand of barrels a day the amount of oil that is imported, and, therefore, have essentially the same effect on the trade imbalance.

I would point out to you that there is a market that neither one of these projects can address. Namely, the energy needs of the LDC countries of the world. We have reason as part of our marketing studies to model a number of these countries. Certain facts have become evident. The energy planners of these nations have been attempting to move off oil dependency and have put together plans for development of coal and nuclear power as the main compounds of their energy mix into the next century.

The fact remains that the capital investment for either nuclear or coal is beyond the capacity of many of these nations. Even those nations with indigenous coal reserves are developing those reserves primarily to place that coal into the export market to gain foreign exchange. It is inescapable that oil technology is the medium of energy in the LDC's and will remain so because they simply cannot afford to change. I would point out that these nations have a population growth curve outpacing anything in the industrialized world and will represent approximately 25 percent of the world's energy consumption by the mid-1990's. I would like to be able to tell you that this conclusion was only obvious to me but that is not the case. Nations around the world that have remote gas are beginning to develop alcohol and alcohol fuel related projects to address that market in the LDC countries as well as the growing alcohol fuels market in the industrialized world. The import of alcohol fuels into the United States has increased 68 percent over the past year. I spoke earlier in my testimony of the need for synergism, a resource development plan. That is exactly what we propose through our project in Alaska. We are the licensee in Alaska for the Methacoal process and it is our proposal to use both Alaskan coal and Alaskan gas in this symbiotic fashion to produce a product that will compete not only in the industrialized world, but in the LDC's as a substitute fuel for petroleum.

This allows a much broader horizon to be viewed when talking about the development of North Slope natural gas because it does address that very critical market that neither LNG or domestic gas supplies can do. Our Nation's trade imbalance, which this year will approach $70 billion, is staggering to say the least. There are those who might argue that in a world of central banks and currency exchange that the numbers are not as dramatic as they seem at first. I would counter by saying that the $70 billion translates into very human terms and accounts for the unemployment of some 1.3 million American workers.

I, therefore, believe it's incumbent upon this Nation to undertake wherever possible resource development programs that can address this imbalance and put Americans back to work.

Briefly before closing, Senator, there are two other aspects of this development that should be discussed. We have done extensive marketing analysis on the west coast and have carried on discussions with west coast utilities. When alcohol fuels can be provided into the stationary power market on the west coast at competitive prices and in sufficient quantities, the benefits that will accrue are many. Specifically, it gives the utilities an option to imported low sulfur oil and the fact that alcohol fuels are extremely clean burning, it is a cost effective way of addressing the serious environmental problems that exist, particularly in the south coast air basin.

Finally, the impact on the State of Alaska and more specifically, on the interior. This is a point that both you and I can relate to coming from the interior. Government has become our largest basic industry. The socio-economic analysis that we have undertaken indicates that in the Greater Fairbanks area, we are presently running at an aggregated dependency level of almost 79 percent. This, as any political economist could tell you, is an extremely unhealthy situation. AIR's project would create approximately 1,000 permanent private sector jobs. Any of the conservative multipliers that one would apply would indicate a dramatic effect in reducing the dependency on the public sector.

In closing, Mr. Chairman, I have appreciated the opportunity you have afforded to me to speak here today, and to bring to this forum what we believe to be exciting opportunity for the development of Alaska's resources and for the Nation as a whole. Thank you very much.

Senator **Murkowski**. Thank you very much, Mr. Dempsey. Your reference to 79 percent of the economy in the interior being dependent on Government is truly staggering and somewhat frightening, and I would concur with your analysis. The possibilities of moving away from this are very real in the sense of taking advantage and developing resource base, particularly with gas.

I think it was pointed out in the testimony by Yukon Pacific that they indeed would propose to route gas in an available and appropriate manner to the greater Fairbanks area. I assume there is some satisfaction in that.

I would concur that you have, indeed, waited a long time for this gas line of one form or another, and I would share that. As we both know, the dictates of the owners of gas are going to be primary in determining when and where the gas market is, because that's just the name of the game.

However, I think it appropriate to note that Bob Bettisworth represents the ownership of one-eighth of the gas collectively in his responsibility as a member of our State's legislature, and I think it is indeed appropriate to recognize that this testimony states that he proposes to, in effect, offer some 2.4 trillion cubic feet of gas, at least in sharing with his colleagues the appropriateness of that being put up to determine whether or not there's a market; assuming there's about 30 trillion cubic feet. That would be interesting to see, and might be enlightening. On the other hand, it might be disappointing, but it is one way to find out. Obviously it doesn't appear that the State has enough gas to enter into negotiations with Arco. It seems more anxious than Exxon or Sohio to move that gas.

I would ask you, Representative Bettisworth, from your prospective, if you think it's likely that the State legislature would be willing to participate in some equity arrangement in the gas line? This has come up for discussion in your body previously.

Mr. **Bettisworth**. If there is a guarantee that sufficient quantities are made available for in-State use, yes. I believe that the legislature would agree that the State participate.

Senator **Murkowski**. Gentlemen, with that, I would basically summarize for the record the hearing that we've had today, there have been several different approaches to the marketing of Alaska's natural gas. They have been thoroughly examined in an appropriate manner and in a timely manner. We've got the ANGTS and we've got the TAGS, and we don't know who's tagging and who's not, but I think we've got an indication of the dedication that has gone into both proposals as far as pursuing it.

Some have testified that there are competing projects, and others indicate that they can coexist, and in the middle, of course, is the Federal Government, which simultaneously must promote the sale of gas in East Asia as a consequence of our President's negotiating agreement. That may have some implications in Korea we well, while maintaining the franchise that has been dedicated to bringing Alaska gas to the lower 48 markets.

I guess I'm pleased by the differences of opinions. I'm not at all surprised by it. It's been evidenced here today by the private sector that represents the free spirit and is alive and well, the competitive factors that dictate resource development from within our country.

The opinions have been based on what the witness' analyses of what the project would provide, and the best rate of return to the corporations under current market conditions, or projected market conditions, based on their individual investment.

I point out again that the Federal Government is promoting the sale of gas overseas. We will still maintain a franchise on the delayed project that was granted waivers for an expeditious construction, and that's just the realities of it.

I think, however, when Congress returns in 1984, I would plan to work with my colleagues and with the administration to try and determine what is indeed best in the interest of the nation and to bring Alaskan gas into the market first, because I think it has been indicated by the panel representing the owners their willingness to sell gas in the market, if the market indeed dictates that that gas can be sold, and I think that is probably comforting to both proposals.

Our energy and trade policies sometimes are unnecessarily contradictory, but that does happen.

I would invite you that have participated individually in this hearing to feel free to address the issue in any way which you feel the Government can be more responsive to the granting of one form or another to expedite the movement of Alaska gas for the record.

Again, Mr. Peters and Honorable Susan Collins, mayor, will submit written testimony which will be included in the record in full. The hearing will remain open for 30 days for additional comments and responses to any written question from the subcommittee to any of the witnesses.

I would like to thank our court reporter. For those who are not aware, she has repeated every word that has taken place here, and that's no small chore; and our professional staff that has spent a good deal of their evening.

Today is November 16. That happens to be the anniversary of President Nixon's signing into law the Trans-Alaska Pipeline, and I would hope that these hearings will somehow resolve the expedited removal of Alaska's natural gas.

With that, I will conclude, and thank you.

[Whereupon, at 7:30 p.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

The Federal Inspector
Alaska Natural Gas Transportation System

Room 3412, Post Office Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20044

January 13, 1984 D-0025066

Honorable Frank Murkowski
United States Senate
Washington, D. C. 20510

Dear Senator Murkowski:

This is in reply to your letter of November 29, 1983. Enclosed is the Office of the Federal Inspector's response to the questions submitted following the Subcommittee on Energy Regulation's November 16, 1983 Hearing on Marketing Alternatives for Alaskan Gas.

Should you have any further questions, please contact me or my Deputy, Peter L. Cook on 275-1100.

Sincerely yours,

John T. Rhett

John T. Rhett
Federal Inspector

Enclosure

1/13/84

Question: The Office of the Federal Inspector was created as a sort of "experiment" in the regulation of large projects. The creation of OFI embodied the concept of "one stop shopping" for permitting. As well, you oversaw the incentive rate of return mechanism and reviewed engineering, financing, and environmental concerns. a. What was successful and what wasn't? b. What, if anything, not peculiar to ANGTS would you consider for other projects?

a. Answer:

The Office of the Federal Inspector (OFI) is an "experiment" in the regulation of large projects. Overall, the concept and execution have been very successful. This success can be attributed primarily to the following three factors:

- focus of responsibility in one agency responsible solely for the Alaska Natural Gas Transportation System (ANGTS);
- coordination of governmental activities related to this project; and
- development of a balanced oversight philosophy which avoids the extremes of too much or too little oversight and encourages the project sponsors to understand and internalize the objectives sought by the government.

First, one person, the Federal Inspector, was given authority and responsibility for all the Federal Government's oversight of the project. Thus, the Federal Inspector was given independence and accountability. In addition, the Federal Inspector was given responsibility only for this project, so he would give it his highest priority, and his authority was substantially reinforced by the charge to expedite the project.

By having a focus of responsibility in one agency, the Federal Government has been able to minimize the duplication of effort, reduce procedural conflicts, and speed up the regulatory process. On a project that is one of the most expensive ever built, these benefits are significant.

Second, the Federal Inspector has actively sought to coordinate the actions of the project sponsors and those of Federal and State agencies. From the beginning, OFI has been interacting with the project sponsors and the Federal and State agencies on all aspects of project planning and design to ensure consistent Federal oversight and direction.

This consistency on the part of the Federal Government has greatly facilitated planning and execution of the project. In addition, the Federal Inspector has been able to resolve quickly any conflicts among Federal and State agencies in order to keep the government approvals' process moving smoothly.

Third, the Federal Inspector has developed a balanced oversight philosophy which avoids the extremes of too much or too little oversight. In carrying out its mission, the OFI has promoted a regulatory climate in which the sponsors of the ANGTS project had initial responsibility to police their own actions to build the pipeline safely, efficiently, and expeditiously. The OFI has closely monitored and audited the project sponsors' procedures to assure that the sponsors were satisfactorily fulfilling this responsibility.

This has resulted in a sound and cost-effective application of the OFI's regulatory enforcement authorities. At the same time, the project sponsors have developed a workable understanding of the government's objectives and have been able to develop plans and designs consistent with these objectives. By having a workable understanding at an early stage of the project, possible subsequent conflicts with government agencies have been avoided.

OFI, as the focus of responsibility for the ANGTS project, has coordinated governmental activities and applied its oversight philosophy most successfully in the areas of permitting, judicial review, environmental and engineering review, cost control, and intergovernmental relations. A detailed discussion of the successes and problems in each of these areas is given below.

Permitting

Under Reorganization Plan No. 1 of 1979, the OFI is responsible for scheduling and expediting the issuance of permits and other authorizations by the Federal agencies. The OFI thus serves as the "one window" point for filing, reviewing, and issuing of those permits. It also can evaluate any discretionary terms and conditions in the permits to assure that the permit stipulations do not impair project expedition. Our experience has been such that the "one window" process could not have worked as smoothly as it has without the explicit scheduling and expediting authority.

The "one window" approach to regulation, as administered on the Eastern Leg of prebuild construction, not only simplified the permitting process, but also expedited approvals for the pipeline sponsors, who were able to deal primarily with the OFI on all major issues and approvals. The orderly and timely flow of permit approvals during Phase I construction has been praised publicly by government officials and the ANGTS sponsors alike. That the Eastern Leg was built basically on time and under budget lends credence to the concept of focusing Federal government responsibilities for this type of project at the outset.

Judicial Review

The Alaska Natural Gas Transportation Act of 1976 (ANGTA) contained a special provision for expedited judicial review, so that any legal disputes over the ANGTS could be resolved quickly and thereby not delay construction. This has proven to be very successful, not only in settling lawsuits in a timely fashion, but also in containing marginal legal matters and forcing the early resolution of controversial issues in general.

Expedited judicial review, along with the expedition of permits and the "one window" process, have provided the project sponsors a great degree of predictability with respect to government actions. Knowing that a specific issue would be handled in a certain way and within a certain timeframe has given the sponsors the opportunity to better control their construction schedules and expenditures. Also, if the statutory requirement that the project be privately financed is to be fulfilled, the private sector must have confidence in the ability of the Federal government to perform its oversight function in a responsible and consistent manner. On a project of this magnitude, minimizing the potential for undue cost overruns caused by Federal actions will have a great impact on the willingness of the private sector to provide financing.

Environmental Review

The environmental reviews conducted by the OFI have been very successful to date. This success resulted primarily from early agreements among the environmentalists, the pipeline sponsors, and the OFI as to the true environmental concerns. The environmental action groups and the company planners got together at the outset to determine the potential trouble spots so that concerns would not arise at the last minute and slow up the project. With the combined efforts of all of the project participants involved in environmental protection, a successful system was developed to determine and track sensitive environmental areas. With this cooperation, it was relatively easy to isolate and solve environmental problems so that costs were kept down and disruptions were avoided. In no instance did environmental concerns delay or halt the project.

Engineering Review

Engineering review has been a success mainly because the OFI established an effective system of monitoring engineering criteria, plans and specifications. The approach taken was to concentrate on the design criteria, to see that they were properly developed, and to focus on the more difficult engineering issues, to assure that they were adequately addressed. A more detailed design review by the OFI would not have been cost-effective because it would have duplicated the competent efforts of Northwest Alaskan (NWA), the operating partner for the Alaskan Leg, and the partnership, which monitors the design effort, and because of the expense of the workforce that would be needed to review plans and specifications in detail.

Another major engineering success has been the development of a system by NWA to mitigate the effects of frost heave on the pipeline. This effort required substantial research and development, as well as engineering work. The OFI provided a regulatory framework that involved substantial interaction that was conducive to this work while still assuring full review for proper Federal approvals. To accomplish this, the OFI assembled a task force of some of the foremost arctic engineering specialists to support the sponsor's efforts and to provide advice to the Federal Inspector. As a result of NWA's endeavor, a promising, innovative frost heave design has been developed and granted conditional approval by the OFI. The OFI oversight philosophy at work in design review and for all technical matters was and continues to be that the various project participants must identify and resolve problem areas early to prevent any subsequent schedule delays and, thus, cost inefficiencies.

Cost Control

The project sponsors are responsible in the first instance for cost control; however, the OFI is charged with monitoring to assure that this occurs. This is accomplished not only through the agency's responsibility for general oversight, assessment of management efficiency, design and procurement review, and audit, but also through its administration of such direct cost control mechanisms as the Incentive Rate of Return (IROR) and rate base audits. The IROR, developed by the FERC, has been and will be administered by the OFI during the planning and construction on the Eastern and Alaskan Legs. This mechanism was designed as a means to offer the ANGTS project sponsors a positive reward for superior cost and schedule control. Generally, if actual construction costs are less than (greater than) projected capital costs, the sponsors earn a higher (lower) rate of return on equity.

The OFI is currently evaluating the effectiveness of the IROR mechanism as applied to the ANGTS, and any conclusions at this time would be premature. On the surface, the IROR was successful on the Eastern Leg prebuild because actual project costs came in below estimated costs. While the IROR has merit, it is extremely difficult to administer; consequently, further studies of its costs and benefits are necessary.

The second cost monitoring function is an ongoing project cost audit, which at regular intervals, provides ANGTS sponsors with incremental determinations on rate base formation. In this manner, OFI determines the "prudence" of sponsor expenditures periodically, allowing early correction of management problems, rather than issuing a summary cost judgment at the project's conclusion.

Intergovernmental Relations

A final area in which the single focal point concept of an OFI has been extremely effective is intergovernmental relations, to include coordination with the Canadians. Through close contact with the States, the Federal Inspector has the ability to avoid delays caused by conflicting Federal and State enforcement actions. In Alaska, where the issues are the most complex, there will be a Joint Federal/State Monitoring Agreeement to spell out the responsibilities precisely.

Good working relationships with the Federal agencies, whose authorities were transferred to the OFI for the ANGTS project, were facilitated by the establishment of the Executive Policy Board (EPB) and the Agency Authorized Officer (AAO). The EPB is an interagency group that convenes periodically to advise the OFI on certain issues and to be a forum for interagency cooperation. The AAOs are liaisons from each Federal agency involved in the project, who represent their organization's interests on a day-to-day and more informal basis. The OFI has further strengthened interagency cooperation and saved money by using existing Federal expertise, such as personnel from the Corps of Engineers, the Bureau of Land Management and the Forest Service, to assist in evaluation and/or oversight responsibilities.

Having a central Federal focus for the project has also been essential for our dealings with the Canadian Government and sponsors. The size and complexity of the project demand close coordination with our Canadian partners, and the OFI has been tailored to meet this requirement. Furthermore, the OFI's relationships with the Canadians have been very good to date.

b. Answer:

We are not aware of any other pending projects which would be comparable to ANGTS. If such a project is undertaken in the future, however, we believe any decision about how best to organize the Federal responsibilities should be made at that time and based on the characteristics of that particular project. Such a decision should take into consideration the intended Federal role, the number of agencies affected, and the type of coordination that is desired.

Department of Energy
Washington, D.C. 20585

January 13, 1984

Honorable Frank M. Murkowski
Chairman, Subcommittee on Energy Regulation
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

On November 16, 1983, Jan Mares, Acting Director, Office of Policy, Planning and Analysis, and Assistant Secretary for Fossil Energy, appeared before the Energy Regulation Subcommittee to discuss marketing alternatives for Alaska natural gas.

Following the hearing, you submitted written questions for our response. Enclosed are the answers to those questions.

If you have any questions, please call Cathy Carey or Tom Pretorius of my staff on 252-4277. They will be happy to assist you.

Sincerely,

Thomas H. Pretorius
for
Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosure

cc: Mr. Howard Useem
Professional Staff Member

Mr. Al Astrin
Committee Staff

POST-HEARING QUESTIONS AND ANSWERS

Relating to the

NOVEMBER 16, 1983, HEARING

Before The

ENERGY REGULATION SUBCOMMITTEE

Of The

SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

CHAIRMAN: SEN. MURKOWSKI

QUESTION 1: A number of legislative and regulatory events have transpired since 1977 which underscore the U.S. commitment to the construction of the ANGTS. However, that U.S. commitment has always been contingent upon private financing. The market has clearly determined that there is no place for Alaska gas in the Lower 48 at the present time, and thus there is no chance for private financing over the near term.

(a) How does the inability to secure project financing affect the U.S. commitment to Canada? If there is no market, and the commitment has always been expressed in terms of private financing, does the commitment still exist?

ANSWER 1a: The United States commitment was to remove regulatory obstacles that may prevent ANGTS development based on private sector financing. These obstacles have been removed. Changes in the energy market which have occurred subsequent to the 1977 Transit Pipeline Treaty and the U. S. - Canadian Agreement on the Alaska Natural Gas Transportation System have resulted in delaying completion of the entire pipeline system.

QUESTION 1b: Should this commitment, be it real or perceived, hold Alaska gas hostage to the Lower 48 market, or should we allow the market to determine where the gas should go?

ANSWER 1b: The U.S. commitment to remove obstacles for a privately financed Alaska Natural Gas Transportation System is not designed to "hold Alaska gas hostage to the Lower 48 market." Market conditions have allowed portions of the ANGTS system to be built with private financing, and when market conditions justify additional investment, private financing will become available to proceed with construction of the remaining sections of the ANGTS. Similarly, market conditions and the judgments of private investors also will determine whether and when any alternative gas transportation system might be feasible.

QUESTION 2: There is a perception that the Alaska Natural Gas Transportation Act of 1976 (ANGTA) and subsequent acts of Congress have "promised" Prudhoe Bay gas to the ANGTS system to the exclusion of all other possible uses of the gas.

(a) From a strictly legal standpoint, is that the case?

(b) (if not) Is it the case from a practical standpoint? Will a banker lend money to a project proposing another use for Prudhoe Bay gas without the "blessing" of Congress - perhaps in the form of a clarification of ANGTA?

ANSWER 2: Although the Department has done some work on the matter, this is a complicated legal issue requiring considerably more review before a final decision can be reached. I am therefore reluctant to speculate on the precise legal impact that existing statutes might have on possible uses for Prudhoe Bay gas.

Any decision on developing or financing new projects for the use of Prudhoe Bay gas will be based on a variety of considerations by a number of parties. I do not presently know the weight that these private parties and financiers will give to the various considerations. Judgments on the attitude of Congress would undoubtedly be a key part of any such decision. However, I cannot say whether an act of Congress amending ANGTA would be absolutely necessary.

QUESTION 3: The Reagan/Nakasone communique specifies that the U.S. will encourage the private sector to undertake feasibility or pre-feasibility studies to determine the extent to which Alaska's gas can be developed for use in Japan.

(a) What steps are you prepared to take to encourage those feasibility studies?

ANSWER 3a: The Department of Energy fully supports the policy stated by the President and Prime Minister Nakasone to encourage private companies to undertake feasibility studies related to the development of Alaska's natural gas resources. DOE is prepared to cooperate with private interests who are engaged in or may undertake such studies, consistent with the principle of private financing.

QUESTION 3 (b) Do you perceive ANGTA as a barrier to free energy trade between the U.S. and Japan as a consequence of any of its provisions which may, as a legal or practical matter, link certain volumes of North Slope gas to the ANGTS?

(c) In terms of foreign policy, perception is generally as important as reality. Have you received any indication from the Japanese that they perceive ANGTA or any of its provisions as a barrier to free trade?

ANSWER 3 b and c: The Department of Energy (DOE) is not aware of any barriers to free energy trade between the U.S. and Japan as a result of ANGTA, however, on specific issues of foreign policy, DOE defers to the Department of State.

QUESTION 4: Given the agreement between the President and Prime Minister Nakasone to seek new possibilities for energy trade, has the Department of Energy taken this issue up with the Koreans or the Taiwanese?

ANSWER 4: The Department of Energy co-chairs an energy working subgroup between the U.S. and the Koreans. The subgroup is chaired by DOE Assistant Secretary for International Affairs, Helmut Merklein. It is expected that this subgroup will convene a meeting in the near future. The potential interest by the Koreans in gas trade witn the U.S. may be an item on the agenda for that meeting.

QUESTION 5: In your testimony, you seem to be saying that U.S. policy as it relates to ANGTS should be responsive to the marketplace. That is, if current U.S. policy favors the movement of Alaska gas to the Lower 48 via Canada, and the market there does not exist, should U.S. policy be modified to allow the market to decide?

ANSWER 5: Consistent with our commitment to remove legal and regulatory barriers that would inhibit the development of ANGTS, in December, 1981, the Congress approved waivers of law which had been proposed by President Reagan. This action was consistent with our overall market-based energy policy. U.S. policy supported the removal of regulatory obstacles that may have prevented the development of ANGTS based on the principle of private financing, subject to market conditions and the judgments of private investors. Our policy does not preclude or prevent private interests from studying the feasibility of possible alternative transportation systems. In fact, President Reagan and Prime Minister Nakasone specifically encouraged such studies during the President's trip to Japan in November. The Department of Energy does not believe that modifications to our market-based energy policy are necessary or desirable.

QUESTION 6: Given the fact that private groups are actively looking at alternative markets for Alaska gas, would you favor legislative amendments to ANGTA, if they were determined to be needed, in order to clear up any uncertainty about the exclusiveness of the natural gas' dedication to ANGTS?

ANSWER 6: The Department of Energy sees no need for legislative action at this time. If, at some future time, private interests are able to demonstrate that provisions of the Alaska Natural Gas Transportation Act inhibit the economic development of Alaska's natural gas resources by effectively preventing construction of feasible alternative transportation systems, DOE would, of course, be prepared to consider appropriate amendments to current law.

DEPARTMENT OF STATE
Washington, D.C. 20520

JAN 23 1984

Dear Mr. Chairman:

I am pleased to transmit the attached answers to questions you posed to the Department of State witness, E. Allan Wendt, following your hearing of November 16 on Alaskan natural gas.

Sincerely,

W. Tapley Bennett

W. Tapley Bennett, Jr.
Assistant Secretary
Legislative and Intergovernmental Affairs

The Honorable
Frank H. Murkowski,
Subcommittee on Energy Regulation,
Committee on Energy and Natural Resources,
United States Senate.

Question 1: A number of legislative and regulatory events have transpired since 1977 which underscore the U.S. commitment to the construction of the ANGTS. However, that U.S. commitment has always been contingent upon private financing. The market has clearly determined that there is no place for Alaska gas in the Lower 48 at the present time, and thus there is no chance for private financing over the near term.

Question 1a: How does the inability to secure project financing affect the U.S. commitment to Canada? If there is no market, and the commitment has always been expressed in terms of private financing, does the commitment still exist?

Answer 1a: The United States maintains its previous policy on ANGTS. The United States has met its commitment to remove regulatory obstacles that may have prevented ANGTS development based on private financing. At the November 16 hearing, the three North Slope producers as well as Northwest Alaska and Foothills Ltd all said they are continuing to work on project financing for the completion of ANGTS. Although there is not a market today for the North Slope gas, Exxon, Sohio, and Northwest Alaska all said they believed that the gas would be needed in the Continental U.S. in the early 1990s.

Question 1b: Should this commitment, be it real or perceived, hold Alaska gas hostage to the Lower 48 market, or should we allow the market to determine where the gas should go?

Answer 1b: The Administration has met its commitment to remove regulatory obstacles and has no intention of standing in the way of private sector efforts to develop and demonstrate the feasibility of other marketing options.

Question 2: There is a perception that the Alaska Natural Gas Transportation Act of 1976 (ANGTA) and subsequent acts of Congress have "promised" Prudhoe Bay gas to the ANGTS system to the exclusion of all other possible uses of the gas.

Question 2a: From a strictly legal standpoint, is that the case?

Question 2b: (If not) Is it the case from a practical standpoint? Will a banker lend money to a project proposing another use for Prudhoe Bay gas without the "blessing" of Congress -- perhaps in the form of a clarification of ANGTA?

Answer 2a: This is a question of interpretation of domestic energy legislation.

Answer 2b: We believe private interests and especially bankers should speak for themselves on their perceptions of lending criteria.

Question 3: The Reagan-Nakasone communique specifies that the U.S. will encourage the private sector to undertake feasibility or pre-feasibility studies to determine the extent to which Alaska's gas can be developed for use in Japan.

Question 3a: What steps are you prepared to take to encourage these feasibility studies?

Answer 3a: At the November 16 hearing, Deputy Assistant Secretary of State for International Energy and Resources Policy E. Allan Wendt referred to President Reagan's and Prime Minister Nakasone's communique encouraging U.S. and Japanese industry to explore the joint development of Alaskan gas resources. We understand that exploratory talks between U.S. and Japanese firms are taking place on this subject. The Department of State is fully prepared to cooperate as appropriate with private interests who wish to undertake privately financed feasibility or pre-feasibility studies. Follow-up discussions on this and other aspects of the communique are planned in Tokyo in February.

Question 3b:	Do you perceive ANGTA as a barrier to free energy trade between the U.S. and Japan as a consequence of any of its provisions which may, as a legal or practical matter, link certain volumes of North Slope gas to the ANGTS?
Answer 3b:	As Sohio stated at the hearing, the owners of the North Slope gas reserves -- Exxon, Sohio, ARCO and the State of Alaska -- clearly have the most incentive to market the gas. To our knowledge, none of these reserve owners have stated that they feel inhibited from exploring other marketing alternatives for the North Slope gas reserves. In fact, at the hearing, both Sohio and Exxon stated that they had already studied the possibility of Pacific-rim markets for the gas, but still thought ANGTS was their best marketing option.

Question 3c: In terms of foreign policy, perception is generally as important as reality. Have you received any indication from the Japanese that they perceive ANGTA or any of its provisions as a barrier to free trade?

Answer 3c: They have not indicated to us that they see any of its provisions as barriers to free trade. In fact, we understand Japanese companies are moving ahead with plans for pre-feasibility studies.

Question 4: Given the agreement between the President and Prime Minister Nakasone to seek new possibilities for energy trade, has the Department of State taken this issue up with the Koreans or the Taiwanese?

Answer 4: We continue to discuss with Korean officials the possibilities for energy cooperation in coal, oil and gas. Obviously, compared to those in the United States or even Japan, the gas market possibilities in Korea are substantially smaller, but it is a rapidly growing market. We have not raised this subject with Taiwan.

Question 5: In your testimony, you seem to be saying that U.S. policy as it relates to ANGTS should be responsive to the marketplace. That is, if current U.S. policy favors the movement of Alaska gas to the Lower 48 via Canada, and the market there does not exist, should U.S. policy be modified to allow the market to decide?

Answer 5: As we stated in our answer to question 1, the North Slope producers, the owners of the gas reserves, continue to believe that they will have a market for the gas in the Lower 48 in the early 1990's. Our policy does not preclude or prevent private interests from studying the feasibility of alternative markets. It is the intention of this Administration to have an even-handed policy toward the development of North Slope Gas so that market forces determine its utilization.

Question 6: Given the fact that private groups are actively looking at alternative markets for Alaska gas, would you favor legislative amendments to ANGTA, if they were determined to be needed, in order to clear up any uncertainty about the exclusiveness of the natural gas' dedication to ANGTS?

Answer 6: The Department of State sees no need for legislative action at this time. If in the future private sector interests, including the owners of the North Slope gas reserves, determine that the provisions of ANGTA are inhibiting them from developing economic alternatives for marketing the gas, the Administration would be prepared to consider appropriate amendments to current law.

NORTHWEST ALASKAN PIPELINE COMPANY

DARRELL B. MACKAY
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January 12, 1984

Honorable Frank Murkowski, Chairman
Subcommittee on Energy Regulation
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

This responds to your letter to Vernon T. Jones of November 29, 1983, which forwarded additional questions in follow-up to his November 16 testimony on the marketing of Alaskan natural gas.

Mr. Jones' answers to the questions are enclosed. You will note that he has included the answer to a question (No. 7) that you asked during the hearing.

Sincerely,

Darrell B. MacKay

Darrell B. MacKay

Enclosure

Response by Vernon T. Jones to Follow-Up Questions from Senate Subcommittee on Energy Regulation

1. At best, how much "old gas" cushion do you expect to have on hand when the ANGTS project becomes a reality?

   Assuming continued price regulation of certain categories of gas below market clearing prices, pursuant to the Natural Gas Policy Act (NGPA), the "cushion" for relatively higher priced gas is represented by NGPA Section 104 and Section 106 gas. The following projections of this so-called "old gas" were obtained from the American Gas Association (AGA):

   Estimated Old Gas as Percentage of Total Lower-48 Gas Volumes (Excluding Direct Sales, Imports, and Alaskan Gas) in Tcf

	Interstate Gas		Interstate Plus Intrastate Gas	
	Volume	Percent	Volume	Percent
1983	4.1/9.7	42%	7.2/13.5	53%
1989	2.8/12.0	23%	4.0/16.1	25%
1990	2.7/12.1	22%	3.6/16.4	22%
1995	1.7/10.9	16%	2.0/15.3	13%

   Source: A.G.A.-TERA Fall 1983 Base Case

   You will note that by 1990 there is expected to be a diminished but still substantial volume of relatively inexpensive gas purchased in the lower-48 states. This recent analysis by AGA may be compared with the project sponsors' October 20, 1981, Congressional testimony. At that time, we presented an estimate that the market in 1987 would have about 25 percent of total U.S. gas supply still regulated below market clearing levels.

2. Because the marginal gas consumer in the United States uses natural gas as a boiler fuel and has the option of substituting some other fuel, the value of North Slope gas in lower-48 markets will be no higher than the price of the boiler fuel it displaces. If you accept that fact along with

the fact that there will be very little, if any, old gas available for a price cushion, then can ANGTS ever really fly unless we experience a significant increase in oil prices, particularly in the fuels the marginal user will turn to?

> As indicated in the answer to the preceding question, it appears that there will be a significant gas price cushion extending into the 1990s. In any event, we do not believe that the marketing of Alaskan gas requires, as a prerequisite, a major increase in the price of residual fuel oil, which we believe will establish the market clearing price for natural gas over the years immediately ahead. Basically, both the project sponsors and the financial community must be assured that real prices of residual fuel oil in the 1990s will support markets for Alaskan gas and at least maintain their value in real terms. As pointed out in my prepared statement (pages 33-40), the key to marketability is the "levelization" of the traditional cost recovery pattern which concentrates the recovery of costs in the early years of project life. As described on page 38 of my statement, the levelization methodology includes two key elements: (1) a deferral of some part of the wellhead price in the early years to be made up with payments in later years and (2) a significant reduction in transportation costs by partial deferral of depreciation and return on equity. These elements can be combined in varying degrees to achieve a target level--the market clearing price for natural gas.

3. How would you anticipate the following natural gas regulation scenarios would affect the marketability of Alaska gas in the lower-48:

   a. Complete and total deregulation by 1990?
   b. Status quo, that is, no change in the NGPA?
   c. Regulation which includes price roll backs, take-or-pay reductions, and prohibition against all indefinite price escalators?

> The answer is the same for the first two scenarios (a. and b.). We believe that, in either circumstance, Alaskan gas must be competitive on a free-market basis, i.e., it must be priced at market clearing prices or it will not be sold. Accordingly, whether there is complete and total deregulation or continuation of NGPA pricing, it

will have no decisive effect on the marketability of Alaskan gas in the lower-48 states. We have, however, testified that the current uncertainty concerning gas pricing deregulation and contract-relief measures must be resolved. This is an essential step toward the restoration of orderly conditions in the natural gas industry, including elimination of financial uncertainty which militates against long-term planning.

With respect to the third scenario, i.e., reregulation, it is not possible to speculate on this in a meaningful way without specifying a large number of assumptions. There is a wide spectrum of possible governmental actions which conceivably might either help or hinder the marketability of Alaskan gas.

4. What is your position on natural gas deregulation? Is that position consistent with your desire to see ANGTS built?

Speaking as Chairman of the Board of Partners of the transmission company sponsors and as Chairman of the Design and Engineering Board, which includes the producers, we have taken no collective positions as project sponsors with respect to natural gas deregulation. As indicated in my answer to the preceding question, we are convinced that the gas can be sold at market clearing prices regardless of either continued NGPA pricing or total deregulation.

5. Right now, the permit held by Northwest has no expiration date. How long should Alaska and the nation wait for ANGTS to get started?

With the recognition that Alaskan natural gas is important to U.S. national security and domestic energy interests, which has been repeatedly reaffirmed by the Congress, the key uncertainty is when, not whether, the need for this gas in the lower-48 states will become acute. So long as the future need for this gas in the U.S. is recognized, it would be prudent and in the national interest for all interested parties to continue to support the ANGTS as the best means of bringing Alaskan gas to market.

6. Are you seeking, or will you seek, additional Federal help in order to get under way?

   Current governmental guidelines call for the project to be constructed without federal financial support. This continues to be our objective, and we have no plans to seek such support based on conditions as they exist at this time.

7. What is your rough estimate of how much more expenditures would be required prior to initiation of an actual construction contract for the Alaska section of the pipeline?

   A rough estimate of the additional expenditures required by the project sponsors prior to implementation of a construction-phase contract, excluding commitment for major materials and equipment procurement, is about $475 million. Most of this expenditure will be required for the detailed production engineering drawings and related work which will be done following final FERC certification and full remobilization of the project. This is in addition to the nearly $700 million already expended on the Alaskan segment, including both the pipeline and the Alaska Gas Conditioning Facility.

YUKON PACIFIC CORPORATION

January 19, 1984

The Honorable Frank H. Murkowski
Chairman
Subcommittee on Energy Regulation
Committee on Energy and Natural
  Resources
United States Senate
Washington, D.C. 20510

Dear Senator Murkowski:

You have asked five additional questions for the hearing record of November 16 on marketing alternatives for Alaska natural gas.

Here are the answers which I am proud to present on behalf of Yukon Pacific Corporation.

1. If TAGS becomes a reality, could gas be brought into the U.S.?

If the Trans-Alaska Gas System, as envisioned by Yukon Pacific Corporation, is built, the gas could be brought into the United States with the approval of the Federal Energy Regulatory Commission.

At this time, Yukon Pacific does not envision moving gas to the United States and is therefore pursuing its project as an intrastate gas pipeline for export only. It is pursuing this course for three reasons. First, there is already pending a proposal to bring Alaska gas in a liquified form to the West coast of the United States. It is likely that the PacAlaska LNG project, which is well through regulatory proceedings, would take up any market demanded by the United States before it would demand more expensive North Slope gas. Second, we do not foresee a market for Alaska gas in the Lower 48 because of less expensive alternative sources. The cost of American produced gas as well as imported gas over pipelines from Canada and Mexico is likely to supply the United States for a long time to come. Third, we believe American economic regulation of interstate pipelines is not conducive to the financing of a large-scale project across Alaska. Economic pipeline regulation means that financing options are limited and that the financial structure of the pipeline is much

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less flexible. In an international market, which we seek, our regulator is the prevailing market price. We are not constrained by an artificially set rate of return, nor is there an incentive to raise the cost of construction in order to build a rate base. Ours is not a utility gas pipeline.

a. What are the regulatory restrictions?

While we plan to pursue this project as an international one, the regulatory restrictions in time of emergency are not all that strong. Assuming there is a facility to receive North Slope gas in the Lower 48, Alaskan gas could be brought into the Lower 48. The question remains whether the market is prepared to pay for that gas. It may be possible to regulate interstate LNG from the liquefaction plant itself and construe the pipeline as a gathering system on the theory that the gas delivered to the conditioning plant at tidewater would not be pipeline quality gas.

We read ANGTA (the Alaska National Gas Transportation Act) as not precluding the export of North Slope gas. Indeed there is a provision that allows the gas to be exported by a presidential decision.

b. Would it be economic to bring it into the U.S.?

Because of the cost of alternative fuels in the United States and the availability of substantial gas resources much closer to the market, we question whether it would be economic under current conditions to bring Alaska gas to the United States under any system, including ANGTS. Our system would be cheaper than ANGST's, however, and would allow deliveries to American consumers at any time that the national interest required Alaska gas in the Lower 48. This was accomplished during an emergency from the Phillips-Marathon plant in Nikishka a few years ago.

2. How do you feel about the role of the Federal Inspector? Would a similar entity be needed to oversee an export project such as TAGS?

The Federal Inspector has two roles in his oversight of ANGTS. First is the "one window" concept which is supposed to expedite permitting. Second is the responsibility to execute the "incentive rate of return" which was an experiment to try to keep the construction costs of the project down.

We believe the first role of the Federal Inspector -- that of expediting the regulation of the project -- is better served through the concept of establishing a lead agency to coordinate all of the permitting with the federal government. In Yukon Pacific's case, we plan to work with the Bureau of Land Management within the Department of the Interior to undertake this lead agency function. To add a Federal Inspector for this role would be redundant if we are able to count on the attention and persuasive power of the Cabinet-level leader of the Bureau of Land Management, the Secretary of the Interior.

The second role of the Federal Inspector is also redundant with an export project. Because this project would not be economically regulated, there is no incentive rate of return to enforce. Indeed, the best regulator on the construction costs of this project is the market. I am not sure that the Federal Inspector was successful in keeping costs down for ANGTS.

3. With a project such as ANGTS which envisioned the sale of gas to a regulated, Lower 48 market, we came up with an incentive rate of return mechanism to fight cost overruns. Are you convinced that you can build a pipeline at the costs you say you can?

If we cannot build a pipeline at the cost we say we can, we lose our market. If we do not have the confidence of the buyers and sellers that the pipeline can be brought in at cost, we do not have a market. I am convinced that the costs of operating in Alaska have improved in recent years as we have gotten to know much more about operating in the arctic. This project will take advantage of many new technologies which can lower the costs of the pipeline and will make pipeline construction costs more predictable. Further, because we are working within existing rights-of-way, some of which are almost a century old, I think we must be beyond the cost overrun syndrome of the last decade. I believe that as much money has been spent on oil development on the North Slope in more hazardous conditions than was spent on the oil pipeline that crosses Alaska today. Most of that development has taken place since the oil pipeline was completed and most of that development comes in regularly on budget.

4. Can you give us an idea of what regulatory path you intend to pursue?

Yukon Pacific intends to pursue a federal regulatory path with two agencies. First, the Bureau of Land Management will be approached for a right-of-way permit as the owner of much of the land we intend to cross. We look at the BLM as the lead agency for the other permits this pipeline would require, including permissions from the Army Corps of Engineers, the Department of Transportation, the Environmental Protection Agency, and other federal agencies.

Second, we intend at the time of completion of contracts to seek permission with the Economic Regulatory Administration of the Federal Energy Regulatory Commission for approval to export natural gas. We assume the presidential finding and decision required under the Alaska Natural Gas Transportation Act would be dealt with at that time.

Yukon Pacific Corporation, as of December, has notified the Federal Energy Regulatory Commission that it does not believe the pipeline we envision is subject to FERC jurisdiction. We have already testified about the possibility of new legislation which would help the financing and marketing of this project.

5. How can the U.S. help in your marketing efforts? Is the work of the U.S./Japan energy working group sufficient, or would other steps be helpful?

The United States has been very helpful in opening the doors to markets for this gas in Korea and Japan, most significantly with the progress of the Energy Working Group culminating in President Reagan's visit last fall.

We must all realize that this is one of the world's largest projects and it requires the cooperation of at least four nations -- the United States, Japan, Korea, and Taiwan. That in itself is very exciting and a challenge for diplomacy. There may come a time when a four-nation treaty might be useful to promote this project on this and other energy matters. I would hope that the United States government continues to seek the type of international cooperation necessary to develop this gas. As this nation seeks to balance its payments with each of those nations, this project can be looked upon as a significant potential contributor to American trade abroad.

Just recently, for the first time in 200 years, American trade with Pacific nations surpassed our trade with Atlantic nations. The day of the Pacific has come. Alaska, as the closest state to our Pacific neighbors, has a significant role to play in this trade. In order for America to remain a player, we must be active Yankee traders, ready and willing to sell.

Thank you very much for allowing me the extra time to elaborate on these questions.

With best regards,

Sincerely,

WJH by EAE

Walter J. Hickel
Chairman

WJH:sb

ARCO Oil and Gas Company
Post Office Box 2819
Dallas, Texas 75221
Telephone 214 651 4206

Stuart C. Mut
Senior Vice President

January 11, 1984

Honorable Frank Murkowski, Chairman
Subcommittee on Energy Regulation
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Senator:

I am attaching answers to the several additional questions you posed to us as a follow-up to the December 16, 1983 hearings on marketing alternatives for Alaskan natural gas.

We continue to have an active interest in bringing Alaska gas to market, and are exploring other potentially feasible alternatives while continuing our participation in the ANGTS consortium. You may be interested to know that we have had very preliminary discussions with several of the major Japanese trading companies over the past several months, and look forward to the opportunity to cooperate with them or other Japanese entities in more definitive feasibility studies.

Very truly yours,

S. C. Mut

SCM:nw
Attach.

ARCO Oil and Gas Company is a Division of AtlanticRichfieldCompany

Responses for the Hearing Record to Additional Questions from Senator Murkowski:

1. If you accept the premise that North Slope gas is "promised" to ANGTS, what volumes are committed?

Answer: The premise that North Slope gas has been committed to ANGTS by ANGTA apparently arises from the fact that the ANGTA empowered the President to select a single transportation system for delivery of "Alaska natural gas" to the contiguous states. The term "Alaska natural gas" was defined as gas from the North Slope of Alaska, including the continental shelf. Hence, if that premise is accepted, it would seem to require the commitment to ANGTS of all gas now or hereafter discovered and developed in the North Slope area of Alaska. The FERC has defined the North Slope as an 80,000 mile square area extending approximately 600 miles from the Canadian border to the Chukchi Sea and up to 200 miles from the Brooks Range to the Arctic Ocean. Estimates of potential reserves on the North Slope, other than the approximately 26 TCF at Prudhoe Bay, have varied considerably; however, the United States Geological Survey in 1975 estimated the "undiscovered recoverable resources" to be between 19 TCF and 99 TCF.

2. There seems to be some uncertainty with regard to whether or not it was the intention of ANGTA to commit certain volumes of gas to the ANGTS. Given that uncertainty, regardless of whether or not it is based on legal fact, would you support a carefully constructed amendment to ANGTA which would clarify that the market should be the ultimate factor which shall determine where Alaska gas should go, thereby giving all parties every opportunity to seek out those markets, regardless of where they are?

Answer: It appears that under the ANGTA North Slope gas committed for sale to the contiguous states can only be transmitted through ANGTS. The existing legal situation, in our view, would permit the sale of North Slope gas for consumption within the State of Alaska or for export pursuant to requisite governmental authorizations. If an amendment is deemed necessary to confirm this view of the existing legal situation, we would support it. We would not support any amendment which would adversely affect the ongoing efforts of ANGTS to meet all requirements for final FERC certification.

2.A. (If not) how long do you believe we should wait on ANGTS given the fact that there is no expiration date in ANGTA with respect to the perceived franchise which ANGTS holds for much of Alaska gas?

Answer: With the one exception of delivery to the South 48 States, alternative methods of bringing North Slope gas to market are not, in our view, precluded by ANGTA. We believe that the ANGTS, having been designated by the President as the transportation system for delivery of North Slope gas to the contiguous states, will retain that status indefinitely unless and until the FERC should determine to deny final certification or Congress passes new legislation.

2.B. How long are you prepared to wait? When do you make the decision?

Answer: Atlantic Richfield is committed to get North Slope gas to market at the earliest possible date. Our consideration of alternatives to ANGTS will be pursued without prejudice to our continuing efforts in support of ANGTS. We believe that sufficient reserves will be discovered and developed on the North Slope to support multiple projects for marketing North Slope gas. To the extent that the market in the contiguous states cannot absorb all (or any) of the gas the North Slope is capable of producing, the desirability of seeking foreign markets cannot be denied.

3. Regardless of your position on ANGTS vis-a-vis the "Y-line concept" as envisioned by Yukon-Pacific, would you object to the sale of your North Slope gas in the Pacific Rim?

Answer: We would be prepared to sell our North Slope gas in any economically viable market including the Pacific Rim.

3.A. If the government asked you to consider taking a look at the Japanese market, as President Reagan and Prime Minister Nakasone have agreed, what would your reaction be? Would you join in a joint feasibility study?

Answer: We would welcome participation in a joint feasibility study to the extent permitted by antitrust considerations.

4. From an economic point of view, how long can you continue reinjecting your North Slope gas into the ground?

Answer: Gas injection into the Prudhoe Bay Gas Cap can continue as long as the field is producing oil at an economic rate. The incremental cost of injecting gas is a relatively small part of the total operating cost of the Prudhoe Bay Field and would not contribute to the earlier abandonment of the field in any significant way.

4.A. Can you explain to us how North Slope oil exploration and production would be positively affected if there was a way to get gas to market?

Answer: North Slope oil exploration and production would be stimulated by the ability to market gas in the following ways:

1. Substantial volumes of gas are necessarily produced in connection with the production of most oil fields. In many oil fields, reinjection of gas is impractical for technical or economic reasons, and flaring of gas is prohibited. Accordingly, such oil fields cannot be developed in the absence of a gas market.
2. The marketability of gas would permit the development of marginally economic oil fields.
3. The availability of a gas market for the North Slope area would stimulate exploration for all hydrocarbons. In the absence of a gas market, exploration efforts are primarily directed towards oil.

SCM:nw
1-11-84

SOHIO

SOHIO GAS PIPELINE COMPANY

MIDLAND BUILDING, CLEVELAND, OHIO 44115

January 13, 1984

The Honorable Frank H. Murkowski
Chairman, Subcommittee on Energy Regulation
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Senator Murkowski:

I am enclosing, on behalf of Frank E. Mosier, questions which you sent to him as a follow-up to the November 16, 1983 hearing. Mr. Mosier is away today, but he reviewed and approved these responses before he left.

Very truly yours,

CWKarcher

C. W. Karcher

CWK/cah
Enclosure

Responses of The Standard Oil Company (Ohio) to Additional Questions for the Hearing Record from Senator Murkowski.

Question No. 1

If you accept the premise that North Slope gas is "promised" to ANGTS, what volumes are committed?

Response

No specific quantity of North Slope gas was committed to ANGTS by ANGTA. The purpose of that Act, in part, was to provide a means of selecting one of several competing transportation systems for delivery of Alaska natural gas to the contiguous States. The President selected ANGTS as that system. Given that selection and the clear Congressional intent as expressed in the Act that a domestic gas transportation system be built, it seems obvious that it was the intent of the Act to "commit" to ANGTS sufficient quantities of North Slope gas to assure the economic viability of the project.

Although under certain circumstances export permits for North Slope gas would be allowed with the Act as currently written, issuance of permits that economically undercut ANGTS would probably be an abuse of discretion and could be set aside. Since the currently recognized quantity of proven North Slope reserves is insufficient to support both ANGTS and an export project, authorization of an export project at this time would be, we believe, contrary to the intent of the law.

Question No. 2

There seems to be some uncertainty with regard to whether or not it was the intent of ANGTA to commit certain volumes of gas to the ANGTS. Given that uncertainty, regardless of whether or not it is based on legal fact, would you support a carefully constructed amendment to ANGTA which would clarify that the market should be the ultimate factor which shall determine where Alaska gas should go, thereby giving all parties every opportunity to seek out those markets, regardless of where they are?

a. (If not) How long do you believe we should wait on ANGTS given the fact that there is no expiration date in ANGTA with respect to the perceived franchise which ANGTS holds for much of Alaska's gas?

b. How long are you prepared to wait? When do you make the decision?

Response

We believe that an amendment to ANGTA is not necessary until there is clear evidence of a viable alternative to ANGTS. However, if such an amendment were to be proposed in the belief that it was necessary to eliminate perceived barriers to the success of an alternate project, we would not oppose it, although we would not actively support it either.

Question No. 3

Regardless of your position on ANGTS vis-a-vis the "y-line concept" as envisioned by Yukon Pacific, would you object to the sale of your North Slope gas in the Pacific Rim?

a. If the government asked you to consider taking a look at the Japanese market, as President Reagan and Prime Minister Nakasone have agreed, what would your reaction be? Would you join in a joint feasibility study?

Response

We would not object to the sale of our North Slope gas in the Pacific Rim, but we may have little to say about it. Two participants in ANGTS have contractual negotiating rights to practically all of our North Slope gas. If Yukon Pacific Corporation builds a pipeline from Prudhoe Bay, we will cooperate to the extent possible to make gas available, but, in view of these negotiating rights, we can give no assurance that it will be available.

For practical purposes -- based on our commercial experiences with Japan, recent discussions with virtually all of the major Japanese trading companies, our knowledge of the Yukon Pacific proposal and our experience with Alaskan construction costs -- we have effectively conducted a feasibility study to the point which satisfies us that it would not be productive to devote further resources to such an effort.

Our evaluations have led us to conclude that the substantial market and economic risks of such an LNG project make it a long shot, requiring strong evidence of financial participation by Pacific Rim countries to be viable. While we have concluded that additional study is unwarranted at this time, we understand that others may not have fully satisfied themselves in this regard, and we do not wish to discourage them from pursuing their own independent studies.

Question No. 4

From an economic point of view, how long can you continue reinjecting your North Slope gas into the ground?

a. Can you explain to us how North Slope oil exploration and production would be positively affected if there was a way to get the gas to market?

Response

Gas produced in association with oil at Prudhoe Bay can be reinjected into the formation indefinitely without having an appreciable impact on recoverable oil reserves. A small amount of gas is used as fuel in the process of reinjecting the gas. If no gas were produced for sale during the life of oil production, approximately 5% of the total gas in the field would be consumed as fuel.

If all the gas continues to be reinjected, the amount of gas produced will increase in relation to the oil produced. Therefore, at some point capital expenditures may be required to provide additional compression. Because of the capital and operating costs associated with gas reinjection, the economic breakeven point at which it becomes no longer profitable to produce oil will theoretically be reached sooner than if gas is produced and sold along with the oil. This difference in timing and in ultimate oil recovery is expected to be small, however.

To date the absence of a gas pipeline has not had any perceptible impact on the search for new oil reservoirs on Alaska's North Slope. To say that this will or will not hold true in the future would be pure speculation.

EXXON COMPANY U.S.A.

January 16, 1984

Subcommittee on Energy Regulation
Oversight Hearing on Marketing
Alternatives for Alaska North
Slope Natural Gas, November 16,
1983.

Honorable Frank H. Murkowski, Chairman
Subcommittee on Energy Regulation
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Senator Murkowski:

We are attaching herewith our answers to the additional questions you submitted concerning the captioned matter. If additional information is needed, please advise accordingly.

Very truly yours,

SJR:ct
Attachment

ANSWERS TO THE ADDITIONAL QUESTIONS
FROM SENATOR MURKOWSKI

1. If you accept the premise that North Slope gas is "promised" to ANGTS, what volumes are committed?

ANSWER: As a matter of national policy approved by Congress and two Presidents over the last several years, essentially all salable Prudhoe Bay gas will be delivered to the lower 48 States through ANGTS when constructed. Pursuant to the Alaska Natural Gas Transportation Act of 1976 (ANGTA), President Carter issued a Decision in September 1977 selecting "a transportation system for delivery of Alaska Natural Gas to the contiguous States." The decision designated the project sponsored by the Alcan Pipeline Company in Alaska for such Alaska Natural Gas Transportation System (ANGTS). Section 2 of the Decision describes the nature and route of the approved system and states:

> "The expected volume of gas to be available initially from the Prudhoe Bay field is 2.0 to 2.5 billion cubic feet per day (bcf/d). The system described herein is designed to handle this throughput volume. The capacity of the system could be increased in the future to accommodate additional volume throughput by construction of additional facilities."

The Decision was approved by joint resolution of Congress in 1977. The production plan approved by the state of Alaska for the Prudhoe Bay Field provides for a maximum of about 2.0 billion cubic feet of gas sales per day. Thus, the President and Congress have approved the ANGTS as a project which will transport essentially all the salable natural gas produced in the Prudhoe Bay Field to the contiguous United States. The ANGTA and the Decision do not require Prudhoe Bay producers to sell their gas for transportation through the ANGTS, and we feel free to investigate and pursue alternatives. However, it is doubtful that any federal or state agency would feel free to approve the export of Prudhoe Bay gas until Congress changes such laws. In that sense, Prudhoe Bay natural gas is committed to the ANGTS when completed.

2. There seems to be some uncertainty with regard to whether or not it was the intent of the ANGTA to commit certain volumes of gas to the ANGTS. Given that uncertainty, regardless of whether or not it is based on legal fact, would you support a carefully constructed amendment to ANGTA which would clarify that the market should be the ultimate factor which

shall determine where Alaska gas should go, thereby giving all parties every opportunity to seek out those markets, regardless of where they are?

ANSWER: Our answer to the first question shows that in our view, there is no uncertainty as to the intent of the ANGTA and the Decision to commit all Prudhoe Bay natural gas to the ANGTS when constructed.

We believe there is no need to amend the ANGTA as suggested in the question, to allow the market to determine where Alaska gas should go. In fact, our analysis is that the contiguous 48 States constitute the best market for Alaska gas. Spokesmen for Exxon have stated repeatedly that it is our conviction that the ANGTS should be constructed. We have examined other alternative methods of transportation and have concluded that an overland pipeline such as the ANGTS from the North Slope to the contiguous United States is the best method of marketing North Slope natural gas. Our investigation of alternatives has not been inhibited by the existence of ANGTA. Current experience indicates that others, even those who are not owners of North Slope gas, are equally uninhibited. Unless and until there is a demonstrable need to do so, i.e., the development of a project that proves superior and attracts support of owners of the gas, no purpose would be served in amending the ANGTA.

2.a How long do you believe we should wait on ANGTS given the fact that there is no expiration date in ANGTA with respect to the perceived franchise which ANGTS holds for much of Alaska gas?

ANSWER: The question suggests that other alternative methods for marketing Prudhoe Bay gas are being delayed pending the construction of the ANGTS. In fact, there is no known superior alternative to the ANGTS in prospect. The TAGS project which has been proposed does not have sponsors able to finance its construction, and we seriously question that an LNG export project such as TAGS would be commercially viable. Under these circumstances, and in view of the magnitude of the investment required for the ANGTS and the difficulties to be overcome in planning and arranging financing for the project, there is no need to impose an expiration date upon the ANGTS. If a better project for marketing Alaska gas should be developed and attracts support of the owners of the gas, the ANGTA, the Decision, and international agreements could be conformed at that time to accommodate the better project.

2.b How long are you prepared to wait? When do you make the decision?

ANSWER: Again, the question suggests that Exxon is delaying action on some alternative method of marketing Prudhoe Bay gas while waiting for the ANGTS to be completed. That is not the case. As mentioned in our answer to 2.a above, if a viable alternative to the ANGTS should be developed, the laws might then be changed to permit that alternative. There is no alternative to the ANGTS in which we would be prepared to invest at this time. We believe that there will be a need for Alaska natural gas in the contiguous 48 States in the 1990s. Timing for the construction of the ANGTS depends upon the participants' achieving agreement upon methods for operation of the ANGTS which will assure marketability of the gas delivered to the contiguous States.

3. Regardless of your position on ANGTS, vis-a-vis, the "y-line concept" as envisioned by Yukon-Pacific, would you object to the sale of your North Slope gas in the Pacific Rim?

ANSWER: We are in the business of selling natural gas under commercially sound terms at the best price obtainable. We are not concerned with the destination of the gas after the sale, except that we are concerned that we sell our gas to the best long-term market. Our assessment is that the contiguous 48 States constitute the best long-term market for Alaska gas.

3a. If the government asked you to consider taking a look at the Japanese market, as President Reagan and Prime Minister Nakasone have agreed, what would your reaction be? Would you join in a joint feasibility study?

ANSWER: As mentioned in my testimony filed with the Subcommittee on Energy Regulation, Committee on Energy and Natural Resources of the United States Senate, November 16, 1983, we question the commercial viability of exporting Alaskan LNG to the Japanese market because of the huge investment in pipeline and plant necessary in Alaska. Over a period of several years, we have repeatedly examined alternative methods for marketing Prudhoe Bay gas and have consistently concluded that an overland pipeline such as the ANGTS is the best means of marketing Prudhoe Bay gas. We are willing to share the results of our studies with appropriate government representatives under arrangements that will protect proprietary information. We are not willing to spend additional time and money repeating such studies.

4. From an economic point of view, how long can you continue reinjecting your North Slope gas into the ground?

ANSWER: That question has been answered several times in previous congressional hearings. It will be economical to continue reinjecting Prudhoe Bay gas into the field virtually until commercial depletion of the oil reserve. As the field nears physical depletion sometime in the twenty-first century, the lack of a gas market could cause operating costs to reduce profits from oil sales so that the field would become uncommercial to produce somewhat earlier than if there were a gas market.

4a. Can you explain to us how North Slope oil exploration and production would be positively affected if there was a way to get the gas to market?

ANSWER: If there were a means of transporting North Slope gas to the contiguous 48 States, exploration of the North Slope for oil and gas would be stimulated because there would be an assured market, not only for oil but also for any gas discovered. We doubt that the absence of a gas outlet has deterred North Slope exploration to any meaningful extent; however, as exploration continues and gas prone areas are defined, lack of an outlet will become a problem. Many companies would be reluctant to invest large sums in exploring in such gas prone areas on the North Slope when there is little prospect that the natural gas which may be discovered can be marketed.

5. Your company seems to have the least favorable attitude about alternatives to move this gas. Exxon recently informed the Canadian Government of its continued support for ANGTS. Your company has extensive holdings in Canada. Can you explain how ANGTS would help your gas prospects in the McKenzie Delta?

ANSWER: The Decision as well as the "Agreement Between the United States of America and Canada on Principles Applicable to a Northern Natural Gas Pipeline" signed September 20, 1977, provide for the ANGTS to be designed and constructed to permit a later connection with a proposed lateral, the "Dempster Line", extending to the MacKenzie Delta. When the ANGTS is constructed, it will then enhance the prospects for the Dempster Line to be constructed so that gas reserves in the MacKenzie Delta could be developed and marketed. An affiliate of Exxon owns interests in leases covering gas reserves in the MacKenzie Delta.

5a. If that is a reason why you're supporting ANGTS, why isn't the Canadian subsidiary of Exxon willing to supply additional financing to ANGTS? Can McKenzie River area gas help pay for ANGTS?

ANSWER: Exxon is supporting ANGTS because it provides the best outlet for Alaska North Slope gas, has the best chance of succeeding among projects being discussed, and provides for delivery of gas to the contiguous 48 states in a time frame when all creditable forecasts indicate that the U. S. will need the gas. Exxon's 70 percent owned affiliate in Canada is not a participant in the group of companies headed by Foothills Pipe Lines which are sponsoring the Canadian segment of the ANGTS. It is possible that Exxon's affiliate in Canada might participate in the project for a Dempster Line, but that is a decision which such affiliate will make when the time arises.

If Mackenzie Delta gas is transported in the Canadian segment of the ANGTS, the shippers of that gas will pay transportation charges to the ANGTS owners. To that extent, the throughput in the ANGTS of gas from the MacKenzie Delta would help to pay for the ANGTS.

6. What effect does the fact that Exxon holds interests in Indonesian LNG projects have an effect on the corporation's view toward the competitive marketing of Alaska's gas in the Pacific Rim?

ANSWER: Exxon has no interest in any Far East or other LNG project. Exxon's interests in natural gas reserves in Indonesia and elsewhere in the Far East have not influenced Exxon's view that the United States represents the best market for Alaska gas. Our concern as to the commercial viability of marketing Alaska LNG in the Pacific Rim is based upon the huge investment which would have to be made in Alaska in a pipeline and plant to permit the export of Alaska gas in the form of LNG. We question whether LNG burdened with such high costs could be competitive in this market with LNG from other, less costly sources.

Appendix II

Trans Alaska Gas System: Economics of an Alternative for North Slope Natural Gas Report by the Governor's Economic Committee on North Slope Natural Gas

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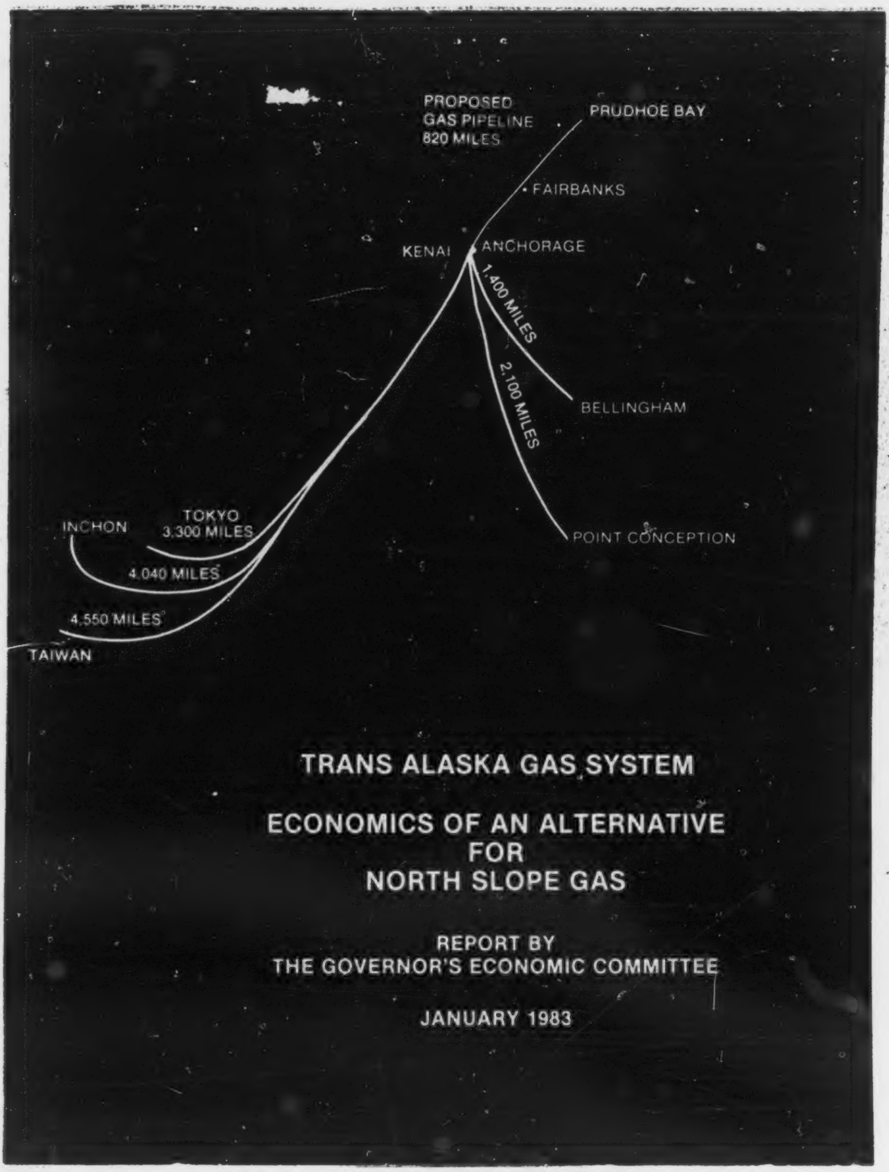

PROPOSED
GAS PIPELINE
820 MILES
PRUDHOE BAY
FAIRBANKS
KENAI
ANCHORAGE
1,400 MILES
2,100 MILES
BELLINGHAM
POINT CONCEPTION
INCHON
TOKYO
3,300 MILES
4,040 MILES
4,550 MILES
TAIWAN

TRANS ALASKA GAS SYSTEM

ECONOMICS OF AN ALTERNATIVE
FOR
NORTH SLOPE GAS

REPORT BY
THE GOVERNOR'S ECONOMIC COMMITTEE

JANUARY 1983

TRANS ALASKA GAS SYSTEM:
ECONOMICS OF AN ALTERNATIVE
FOR NORTH SLOPE NATURAL GAS

REPORT
BY THE GOVERNOR'S ECONOMIC COMMITTEE
ON NORTH SLOPE NATURAL GAS

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JANUARY 1983

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Executive Summary and Conclusions

I. Introduction

This Committee report offers three major considerations for action:

First, the lack of prompt development of a transportation system for moving Prudhoe Bay natural gas and liquids is resulting in a lost opportunity for the nation, state of Alaska and producers of the gas to gain economic benefits and new energy supplies.

Second, the Japanese market for liquefied natural gas will double, at least, by the end of the decade. Anticipated Japanese demand has caused owners of natural gas in Canada, Australia, Indonesia and the Soviet Union, among other nations, to plan and build gas transportation systems to meet this market.

Failure on the part of all owners of Prudhoe Bay gas to act expeditiously in meeting a portion of Japan's needs may irrevocably eliminate any future participation in Alaska's most natural market and could prevent sale of North Slope gas in market through the end of the century.

Third, the Committee's report outlines a Trans Alaska Gas System which can be built, may compete in world markets, is flexible in its ability to respond to changing markets, and offers the nation and Alaska substantial benefits as it responds to the problems cited above.

Fourteen years ago, the largest quantity of oil and gas known to exist in a single North American field was discovered at Prudhoe Bay, Alaska. In 1977, oil began flowing south through the trans-Alaska pipeline. Efforts of the state, the federal government, and private industry to bring that natural gas to an American market have, so far, been unsuccessful.

In June of last year, Alaska Governor Jay Hammond asked two of his predecessors, Walter J. Hickel and William A. Egan and a committee of six other Alaska leaders to seek an alternative system to transport North Slope gas. The Northwest Pipeline project (Alaska Natural Gas Transportation System or ANGTS), selected by President Carter in 1977 to bring the gas across Canada to the central portion of the United States, had just been delayed an additional two years because of financing difficulties.

The Committee is a convenor of experts, rather than expert itself. In transmitting this report to Alaska Governor William Sheffield and the Legislature, the Committee does not presume to make decisions that only the federal government, the state of Alaska, and the gas producers must themselves make. It does attempt to focus public and private discussion toward a proposal that may reach closer to the common goal of bringing Alaska North Slope gas to market.

II. Conclusions

A. The best opportunity: The Governor's Committee on North Slope Natural Gas has determined that a Trans-Alaska Gas Pipeline System (TAGS) from Prudhoe Bay to tidewater with attendant LNG manufacturing and transportation systems provides the best opportunity to deliver North Slope gas to market.

B. Free trade: The Pacific Rim LNG market consisting of Japan, Korea, Taiwan and the West Coast of the United States, is the superior market for Alaska produced resources, including natural gas. America is several years late in approaching this market. Should political barriers inhibiting free trade between Alaska and the Far East be removed now, market forces might allow LNG to move from Alaska to the Far East.

C. National interests: As envisioned, TAGS would make available approximately 4.8 million tons of LNG in 1988. The total system throughput would increase to 14.5 million tons by 1992. Alaska's primary market is Japan. Estimates of Japanese need beyond those sources already committed range from 2 to 9 million tons in 1990 and 9 to 17 million tons in 1995. The possibility of entry of Alaskan gas into this market is increased if:

1. Both nations take their long-term mutual political and economic interests into account.

2. Other projects now planned to deliver LNG to Japan are delayed or found to be less efficient or economic by Japanese buyers.

3. LNG's percentage portion of baseload electric power generation in Japan is revised upward by government and industry decision.

4. Economic growth in Japan rebounds.

D. Higher values: The price of LNG in the Far East has historically been equated to the BTU value of crude oil. It is expected that LNG prices in the Far East will continue to be the highest available to the Alaska energy industry. However, natural gas prices in the U.S. are expected to remain somewhat depressed by the abundance of gas reserves producible at uncontrolled prices. It is unlikely that Alaskan gas will be economically competitive in a free uncontrolled U.S. market over the long term.

E. Lower costs: The Trans Alaska Gas System (TAGS) pipeline with attendant conditioning and LNG manufacturing at tidewater is a concept designed to be built for the lowest possible capital costs. Project economic feasibility also depends upon a number of factors subject to considerable uncertainty such as future energy prices, general rates of inflation, capital costs and construction costs. However, making reasonable assumptions as to these factors it appears that LNG delivered through TAGS could compete in Japanese markets.

	Estimated Cumulative Construction and Organization Costs in 1982 Dollars (Millions)		
	Phase I	Phase II	Phase III
Pipeline	$4,608	$ 6,276	$ 8,243
Conditioning Facilities	702	982	1,423
Liquefaction Facilities	1,863	2,995	4,628
Totals	$7,173	$10,253	$14,294

The projected costs do not include estimates of inflation or financing costs during the construction period, the cost of shipping or facilities outside Alaska.

F. "Base case" costs and tariffs: "Base-case" assumptions used by the Committee's economic advisors to estimate full costs include:

- 7% annual inflation.
- 14% annual interest costs on borrowed funds.
- 30% and 40% annual after-tax return to equity, depending upon equity risk.
- Japanese LNG market price of $7.89 per MMBTU in 1988, escalating thereafter at 7% per annum - i.e. a small decline in real LNG prices from 1982 to 1985 and no real growth thereafter.

Under these assumptions the economic advisors calculated the full capacity (2.83 billion cubic feet of gas per day) or Total System tariff the pipeline would require. Under the 30% equity return case, the necessary tariff would be $5.67 per MMBTU in 1988 dollars leaving $2.22 per MMBTU in economic value for the producers after shipping costs. Total system capital costs would be $14.3 billion in 1982 dollars and $25.2 billion in "as spent" dollars including inflation and financing costs.

III. The Trans-Alaska Gas System (TAGS)

Close to one billion dollars has been spent so far by proponents of various projects to move natural gas off the North Slope. Any project of this magnitude faces hurdles in engineering, marketing, financing, and the law. With these factors in mind, the Committee recommends consideration of a Trans-Alaska Gas System (TAGS). The Committee believes TAGS has enough special characteristics to creatively and flexibly overcome the obstacles which have kept 26 trillion cubic feet of North Slope gas from coming to market.

In devising the Trans-Alaska Gas System, the Committee and its collaborators wanted to meet the following goals:

In engineering, the prime goal is to keep capital costs down while providing pipeline capacity to carry all of the valuable gas liquids - propane, butane, and pentanes - to market.

In marketing, the key word is flexibility. Markets change, the last five years have shown, and a viable project should be able to change with them.

In financing, the goal is to transport the gas to market at a tariff which, given the market price for LNG, provides both an adequate return for System investors and adequate compensation to the owners of the North Slope gas.

In the law, the goal is to devise a project to face as little legal delay as possible. It is recognized that the most economically viable projects must also be politically and environmentally acceptable.

The Committee believes that the TAGS proposal points the way toward meeting these tests.

A. Project Engineering

Brown and Root, the committee's engineering advisors, have estimated how an 820 mile gas pipeline can be built from the North

Slope to tidewater at Nikiski, near Kenai. Construction is envisioned in three phases. If markets demanded more gas, the entire project could be complete in the five year time period allotted for building Phase I. At the tidewater site, the necessary conditioning of the gas, separation of the gas liquids, and liquefaction of the methane and ethane for shipment as LNG can also be accomplished. In 1982 dollars, which do not include expected inflation or the cost of interest in financing the project during construction, Brown & Root estimates the system will be as reflected in table shown on Page 4.

The three phase system was devised for two major reasons. First, it is expected that no market or combination of markets can take all gas available from Phase III of the project immediately, but that a gradual build-up under a phased concept will increase marketability. Phase I was determined to be the lowest cost, lowest throughput system which might stand on its own financially. Second, financing of the whole project may be facilitated as cash flow from one phase is applied to the cost of the next.

Under the phased concept, TAGS would carry the following quantities of gas to be made available for the world market:

	Phase I	Phase II	Phase III
Expected completion date	1988	1990	1992
Raw gas transported, mmcfpd	950	1750	2830
LNG available, million metric tons per year	4.8	8.9	14.5
Propane, 42 gallon barrels per day	19,000	35,000	56,600
Butanes, 42 gallon barrels per day	10,450	19,250	31,130
Pentanes, plus 42 gallon barrels per day	8,550	15,750	25,470

B. Project Marketing The Committee has sought advice on gas marketing from a variety of sources, including several Japanese trading companies, governments in Japan and Korea, Dow Chemical U.S.A., En-Mar Resources, shipping consultants and several oil producers. Conclusions are necessarily those of the Committee itself.

Because TAGS terminates at a tidewater location, North Slope gas would be available to markets in Asia and the West Coast of the United States.

Alaska's history has shown, whenever transportation costs of a commodity are a major factor, that the natural market for its resources is Asia. Alaskan timber, coal, certain fish species, and natural gas have all found markets in Asia before being sold in the continental United States.

The Committee has concluded that the principal market for TAGS would be Japan. That country is the world's largest importer of LNG. The first LNG shipments to enter Japan began in 1969, from the Cook Inlet of Alaska where TAGS would terminate. About one million tons per year of gas are shipped today under that Phillips-Marathon project.

Three factors affecting marketing have been given special consideration by the Committee: expected demand in a market, prices the buyers can be expected to pay, and likely competition from other suppliers. In formulating the TAGS concept from a financial, engineering, and legal viewpoint, the attempt was made to respond to these factors as flexibly as possible.

Typically, LNG sold in Japan is at parity with world oil prices. Prices are higher there than in the United States. In selecting projected world oil prices, the Committee and its economic advisors used the projections of the Mitsubishi Research Institute which predict a real drop in oil prices between now and 1985, and a static real level of prices from 1985 through the end of the century. Inflation over that period of time is predicted at a level of seven percent per year. Other advisors to the committee predicted real growth in oil prices of up to three percent during the same time.

Target projections of Japanese LNG consumption are made by the Ministry of International Trade and Industry (MITI.) MITI's projections are that Japan will increase its LNG demand from 17 million metric tons today to 43 million metric tons in 1990. Other viewers of the scene in Japan place demand projections in a range of 38 to 46 million tons in 1990.

Combined with the uncertainty of Japanese demand, the strength of Japanese commitments already made to other suppliers leaves a question as to how large the near-term shortfall of supply is by an Alaskan project.

Phase I of TAGS would make available approximately 4.8 million tons of LNG in 1988. Phase III, the total system, ready in 1992, would increase TAGS throughput to 14.5 million tons. Estimates of Japanese need beyond those sources already committed range from 2 to 9 million tons in 1990 and 9 to 17 million tons in 1995.

Markets in Korea and Taiwan may also exist for Alaska gas, though demand is undeveloped in both cases. Korea has agreed to import two million tons of LNG per year from Indonesia beginning in 1988; an additional one to two million tons may be needed about 1990. Taiwan supplies its natural gas needs domestically today, but demand projections of up to two million tons in 1990 may signify a market for Alaska gas.

United States west coast LNG markets have been studied for a considerable time by the Pacific Alaska LNG Associates, proponents of a project to bring Cook Inlet and Indonesian gas to Pt. Conception, California. Concluding that Mexican, Canadian and domestic American supplies delivered overland will cover demand through 1990, the Pac Alaska LNG project sponsors recently delayed commencement of construction until at least 1986, with completion expected in 1990.

Prospects of available Canadian and Mexican gas available as well as less expensive production from a large number of shut-in U.S. wells leads the Committee to conclude that North Slope gas does not have a ready market in the United States in the near term. Should demand for Alaska gas materialize on the west coast, LNG facilities could be constructed at Pt. Conception or Bellingham, Washington, according to sources contacting the Committee.

TAGS will also make available a substantial amount of gas liquids to the world market. For the purposes of economic analysis it was assumed these products would command a tariff in the system equally as high as the methane and ethane components of LNG. Typically, measured on a BTU basis, these products are more valuable than LNG components.

Gas liquids made available by TAGS can be exported or used as a feedstock for a petrochemical industry in Alaska. Propane is demanded for use as an LPG motor fuel in Korea and Japan, and conversion of fleet vehicles and taxis in both of those countries is increasing. Ethane, for the purposes of this study, has been shipped with LNG but could be separated to use as a petrochemical feedstock also.

Natural gas and gas liquids can be used as a feedstock for the creation of methanol or electrical power in the State of Alaska as well. Such use would be beneficial to the community and it is especially needed in Interior Alaska today.

C. Project Economics A preliminary economic analysis of the System was prepared by Dillon, Read & Co. Inc. to determine the economic feasibility of the Trans-Alaska Gas System on a project finance basis.

System economic feasibility means an ability to transport, condition, liquefy, and ship LNG and associated products at a cost which, given projected world energy prices, provides both an adequate return for System investors and adequate compensation to the gas producers. Making reasonable base case assumptions, outlined below, it appears that LNG delivered through TAGS could compete in Japanese markets.

Dillon Read used for their base case analyses the following assumptions:

i) Brown and Root engineered construction and operating costs, and construction expenditure schedules;
ii) 7% annual inflation in construction costs and operating expenses throughout System life;
iii) 14% annual interest cost on borrowed funds;
iv) unregulated tariffs, which escalate with projected LNG prices;
v) 75/25 debt to equity ratio for System capitalization throughout the life of the project;
vi) 30% and 40% annual after-tax returns on equity investment, depending upon project risk assumed by equity investor.

Based on the above, Dillon Read projected TAGS "as spent" capital costs, including financing costs during construction, inflation, taxes and working capital for Phase I (completed in 1988) and the Total System (completed in 1992) as follows:

Total Estimated Capital Costs
(Millions of Escalated Dollars)

	Phase I	Total System
Pipeline	$ 7,569	$14,648
Conditioning	1,104	2,520
Liquefaction	2,883	8,297
Total "as spent"	$11,556	$25,465

Based on these capital costs, Dillon Read calculated a tariff expressed in dollars per million BTU's which, over the life of the System, would be sufficient to cover operating expenses, service and retire System indebtedness and provide the required after-tax return to an equity investor. Two target equity returns of 30% and 40% were used in Dillon Read's analysis reflecting two possible levels of project risk. The calculated tariffs in 1988 dollars for Phase I and the Total System under the high and low equity return cases were adjusted by adding shipping costs to Japan, as estimated by En-Mar Resources, Inc., the Committee's shipping advisor. This final figure represents the total transportation cost of LNG per MMBTU FOB Japan, but does not include compensation to the gas Producers. Subtracting this figure from projected 1988 Japanese LNG prices gives the economic value of the gas to the Producer. This value is set forth below.

Projected Japanese LNG Prices vs LNG Transportation Cost
($ per MMBTU in 1988)

	Phase I		Total System	
	Low Tariff	High Tariff	Low Tariff	High Tariff
Japanese LNG Price forecast	$ 7.89	$ 7.89	$ 7.89	$ 7.89
Transportation cost landed Japan	6.94	8.91	5.67	7.16
Economic value of LNG	$0.95	($1.02)	$ 2.22	$ 0.73

Dillon Read tested the results above for sensitivity to the various assumptions made, as detailed in their enclosed report.

Under base case assumptions, the Total System tariff produces positive economic values for producer gas under both the high and low tariffs. These indicate that the Total System, under the assumptions made and subject to the availability of markets capable of absorbing Total System output, could be economically feasible in the lower tariff case and may be only marginally economic in the higher tariff case. Phase I appears to be only marginally economic under the lower tariff case and clearly uneconomic as a stand alone project under the high tariff case.

In all cases, economic value and required tariffs can be significantly improved if outside parties can be found to share the economic risks associated with a project of this magnitude. Such parties might include the various direct and indirect beneficiaries of a successful project: the buyers and sellers of the gas, the State of Alaska as both a royalty owner of the gas and as taxing body, and suppliers and contractors to the System. As a minimum, commitments by buyers and sellers of the gas are a necessary precondition to moving from this economic analysis to the formulation of a viable financing plan.

D. The Law Birch, Horton, Bittner, Monroe, Pestinger and Anderson, counsel to the Committee, were asked to look at a number of questions regarding the legal status of North Slope gas and the legal viability of a Trans-Alaska Gas System

A central issue was whether proponents of a Trans-Alaska Gas System would need to seek legislation, as other proposed and completed Alaskan pipelines have. The short answer was legally no, practically yes.

Legally, there is no prohibition on exports of North Slope gas if the President makes the finding that those exports will not adversely affect the supply, price or quality of gas available to the United States. If TAGS were an export line solely, it could leave only its shore plant facilities as matters for FERC approval. Commitments to use the gas in the Alaska Natural Gas Transportation System (ANGTS), codified in legislation and by treaty with Canada, seem binding only if private sources can raise the funds necessary to complete the project. No time limit rests on the sponsors of ANGTS to actually build the project or lose their license under the law.

Practically, experience has shown that the strongest decision-maker in an issue such as this is the owner of the resource, led by the market. Government can restrain building but it is hard, without direct government funding, to force building. However, when the financial resources at stake amount to the largest private construction project in history, it is essential to remove any legal "cloud." Thus some changes in the law to support a President's decision to favor system construction and gas exports would be necessary.

Legislation to put federal aproval on a Trans-Alaska Gas System would either amend the Alaska Natural Gas Transportation Act or replace it with a new, but similar measure. Such legislation could avert drawn-out litigation, motivate federal agencies to act expeditiously, and inspire confidence in the financial community for the project.

IV. Special characteristics of the system

Several special characteristics of this system differentiate it from other proposals to move North Slope gas to market, including the previously proposed El Paso project which would have brought North Slope gas to Valdez for shipment to the United States.

A. Conditioning at tidewater: Costs of conditioning the gas at tidewater are substantially less than accomplishing the same task at the North Slope despite the fact that approximately 12.6 percent of the pipeline capacity must be used to carry carbon dioxide, an inert gas with little expected commercial value. Conditioning on the Slope might also include the process of separation of gas liquids. By moving that process to tidewater, the BTU throughput content of the system is increased, adding to the financial viability of the pipeline.

B. Elimination of NGL Pipeline: The Trans-Alaska Gas System has been envisioned by engineers to carry natural gas liquids in the gas stream. At tidewater, gas liquids can be shipped to market or be used within the state of Alaska as a petrochemical industry feedstock. Thus, a separate $3 billion pipeline needed to carry the liquids from the Slope (although some liquids could be carried in the Alyeska pipeline), as projected by the Dow-Shell Petrochemical Feasibility Study in 1981, would not be necessary.

C. More flexible markets: The Trans-Alaska Gas System makes North Slope gas and its respective components available to the world market because of its terminus at tidewater. Thus, if national security concerns dictate that uncommitted natural gas from Alaska must be used in the United States, it can be. If that gas finds a market elsewhere in the Pacific Rim, it can answer those needs too. Over the real life of the project, which is likely beyond the commitment term necessary for financing, the pipeline could serve many different markets.

D. Ownership of the gas: Traditionally, oil producers have sold gas at the wellhead in the United States because, among other reasons, gas is more highly-regulated than oil. Under the TAGS concept, gas producers could own the gas at tidewater as well as at the North Slope. The advantage to this concept is that a "beachhead" rather than "wellhead" price could be established under certain system ownership and regulatory scenarios. This, combined with the flexible market consideration outlined above, allows negotiated sales terms throughout the life of the project which could provide owners of the gas higher returns.

E. Flexible financing: The Trans-Alaska Gas System is made up of several discrete components which can be owned and financed separately or together. Possible advantages here include use of lower cost financing on some system components through tax exempt debt instruments or import-export financing of a foreign supplier or buyer. Different owners may require different equity returns due to varying financial risks of construction completion. Finally, simply because of the large magnitude of the project, it may be advisable to distribute risks among several different parties.

V. Benefits to the Nation

The Trans-Alaska Gas System has a number of benefits to the nation stemming from increased economic activity, better relations with trading partners abroad, and its contributions toward increased energy exploration and independence at home.

The Committee has made the following findings:

1. New energy supplies: It is vitally important to the Nation that North Slope gas be brought to market. Failure to establish a gas transportation system off the North Slope of Alaska has resulted in dampened interest in exploration in the area. The likelihood that gas will be found in certain tracts has lowered the expected value to the extent that drilling has not taken place in promising areas. Without a transportation system, gas must be reinjected, a costly process.

2. Higher federal leasing revenues: Less than the best revenues from federal and state leasing programs are being received because bids are being discounted by the expected cost of gas reinjection.

3. Help to balance trade: America's continuing trade difficulties with Japan, resulting from a large balance of payments deficit with that country, can be helped with energy exports from Alaska, having economic value in the billions of dollars per year.

4. National security: While United States policy has confined Alaska energy development to meet only U.S. demand for energy, export policies of Alaska's neighbors in the Pacific Rim, including the Soviet Union, are answering the needs of Japan and Asian newly industrialized nations. Over a long period of time, the effect of such trade can be to create stronger alliances potentially at odds with the interests of the United States.

5. Transportation efficiency: Given world markets, the tidewater route is efficient. Today, Alaska's oil goes east through the Panama Canal toward Gulf of Mexico refineries while Mexican oil found in the Gulf heads west toward Japan. A similar inefficient circle stands to be drawn if Alaska gas is forced through Alberta toward Chicago while Canadian gas, under a currently pending export proposal, would leave Alberta in the opposite direction to British Columbia and then venture by ship across the Gulf of Alaska to Japan.

6. Economic growth: Government action to spur the nation's economy should not stop with taxing and spending policies. A regulatory decision at the highest government levels to permit this project, help market the gas, and to increase energy exploration with its completion can stimulate the economic growth of the nation without the use of federal funds.

VI. Benefits to the State of Alaska

No matter how promising a proposal, Alaska stands to gain from a project to move North Slope gas to market only if the project is actually built. In design, routing, choice of suggested markets and legal status, TAGS is conceived to be economic, first and foremost. Side benefits to the community will be substantial, and TAGS contains a number of special benefits for Alaska:

1. Value added industry: Alaska's hopes, a strong underlying force behind statehood, have long been to create primary processing of its natural resources within the state. TAGS, by bringing the North Slope gas to tidewater, ensures this opportunity for Alaska — not only at tidewater but along the entire route of the line.

   If the economics are established, Alaska could become a "Gulf Coast of the North," supplying the petrochemical needs of the Pacific nations similar to the way Texas and Louisiana's gulf coast have served the Atlantic nations for over a generation.

The gas liquids that could be extracted from the gas stream represents one of the largest concentrations of these hydrocarbons found anywhere in the world. Gas liquids are the most efficient raw material for a petrochemical industry. Today, in the Pacific Rim, most petrochemical development is based on raw material derived from more expensive crude oil.

The possibility of using portions of the gas stream for a methanol facility based in the Interior of the state is aided by both the route and the content of the pipeline.

2. New power for the Railbelt: Fairbanks, a city in dire need of low cost power, could make the choice of generating power from gas supplied by the line as it passes near the community. As well, power generated at tidewater can be supplied to the entire railbelt region through the proposed intertie between Anchorage and Fairbanks. In-state power generation from North Slope gas will be possible at points along the route using portions of the full-gas stream and at tidewater using methane or a low-btu gas which would be a byproduct of certain conditioning technologies which may be chosen by sponsors of the project.

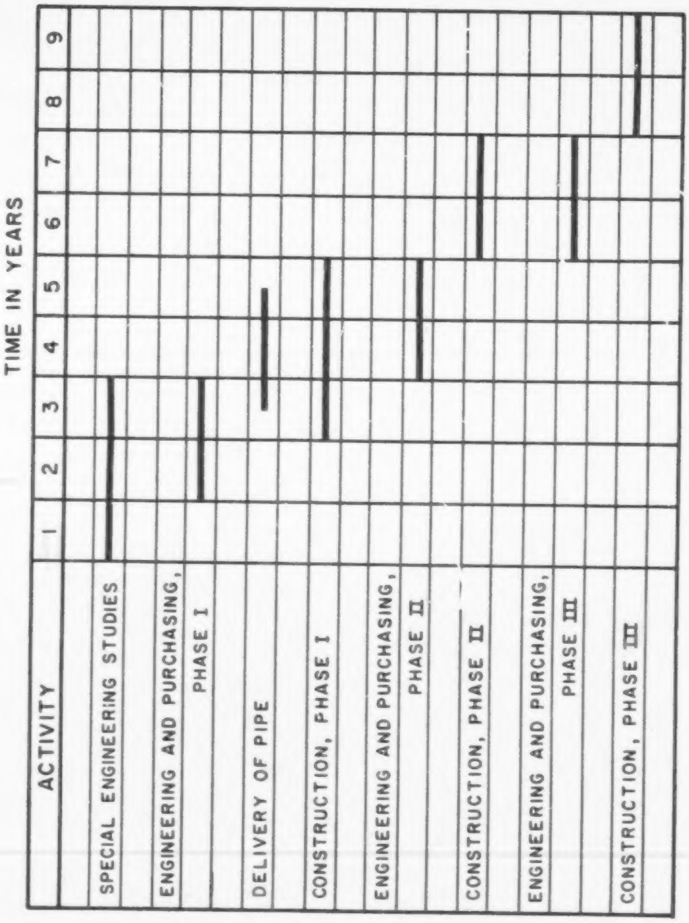
3. State revenues: Alaska's economy is unquestionably based on revenues from natural resource development. Long-term prospects for energy exploration in the state can only be increased by moving North Slope gas. Revenues to state government are expected to decline with Prudhoe production declines in the late 1980's, about the same time this project could be expected to come on line. Revenues from TAGS will accrue to the state as an owner of the royalty portion of the gas as well as from taxes on the system itself. Taxes based on the property will bring revenues to muncipalities throughout the system's length.

4. Employment: Short and long term employment opportunities in Alaska are large with TAGS. Brown & Root, the committee's engineering advisors, have estimated that 310,000 man-months of

labor will be required during the seven years of construction. Full time project operation will require close to 500 people. Data supplied by the U.S. Bureau of Labor Statistics indicates that for every 100 operating jobs in the pipeline and hydrocarbon processing industries, 90 to 130 new jobs will be required locally for support.

VII. Project's potential timetable

Marketing, financing, and legal approvals will govern the timetable of the project. Taking previous experience in Alaska energy projects into consideration, Brown & Root has supplied the following timetable which the committee feels will meet the ambitions of a project sponsor. Construction could begin in three years and gas could be flowing to the market in five years if the engineering process began in 1983.



Brown & Root, Inc. PIPELINE ENGINEERING
HOUSTON, TEXAS

CONT. NO.

TRANS ALASKA GAS SYSTEM
PROPOSED PROJECT SCHEDULE

DWG. NO. FIGURE I-A

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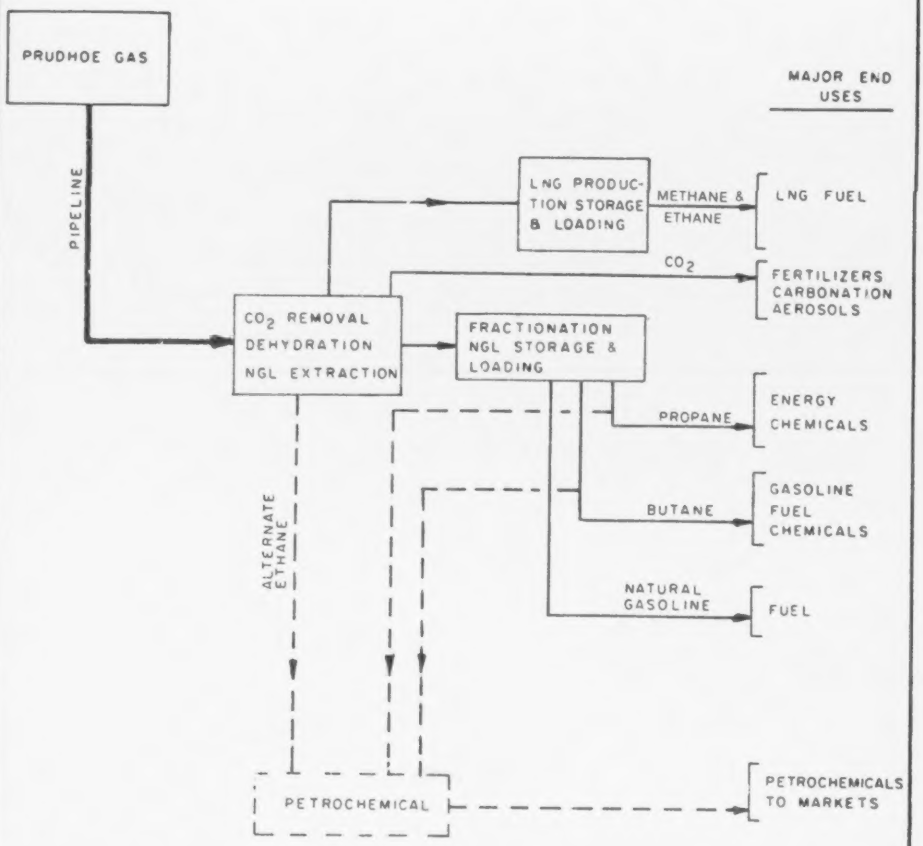
PRUDHOE GAS
PIPELINE
CO$_2$ REMOVAL
DEHYDRATION
NGL EXTRACTION
LNG PRODUCTION STORAGE & LOADING
METHANE & ETHANE
CO$_2$
FRACTIONATION
NGL STORAGE & LOADING
PROPANE
BUTANE
NATURAL GASOLINE
ALTERNATE ETHANE
PETROCHEMICAL
MAJOR END USES
LNG FUEL
FERTILIZERS
CARBONATION
AEROSOLS
ENERGY
CHEMICALS
GASOLINE
FUEL
CHEMICALS
FUEL
PETROCHEMICALS TO MARKETS

DASHED LINES INDICATES ALTERNATE FEEDSTOCK ROUTE.

SOLID LINES INDICATE UNITS INCLUDED IN THIS REPORT COST ESTIMATE.

Brown & Root, Inc. PIPELINE ENGINEERING
HOUSTON, TEXAS

CONT. NO.

TRANS ALASKA GAS SYSTEM
ALTERNATE PROCESS SCHEMES

DWG. NO. FIGURE I-B

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PAGE OF

ENGINEERING

Introduction:

The Governor's Economic Committee on North Slope Natural Gas selected Brown & Root, Inc. as its Engineering consultant and advisor to assist in its study of alternatives for marketing North Slope natural gas.

The information, conclusions and recommendations presented in the following Engineering Section of this report are based on studies made either from historical data contained in Brown & Root's files or from technical expertise from within the Company.

Because of the limited time and budget available for the study no original field work or extended reconnaissance work was performed. Routing for the pipeline has been done by engineers familiar with the area from office map studies with the total length being scaled from topography maps. Quantities of material, modes of construction, production rates, productivity and project concepts have been selected and estimated by Brown & Root professionals who collectively have many years of Arctic experience and are well qualified in this field of expertise.

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TRANS ALASKA GAS SYSTEM

I. TECHNICAL ASPECTS

A. Potential Tidewater Locations

General:

In the time available for this initial study, the engineers made an arbitrary decision to consider only one route to a specific terminal area, rather than making numerous alternate studies. The single terminus area was selected on engineering, legal and economic criteria. In its directions, the Governor's Economic Committee emphasized routing for the lowest capital and operating costs. The engineers were also asked to include in the evaluation legal land status and routing the line as close to Fairbanks as economically justifiable.

The engineers have reconnoitered by helicopter the pipeline routes to most potential locations and are aware of the features hereafter discussed, but have not made what could be considered as in-depth studies of any of the several potential locations.

1. Basic Requirements and Desirable Features:
   - (a) Water depth adequate to handle large LNG, liquid hydrocarbon, or petrochemical products tankers should desirably be close to shoreline to minimize loading dock facilities cost. A 45 foot mean low water depth at dock site is tentatively considered as the minimum desired depth. Preferably this depth should be maintained without periodic dredging requirements.

   - (b) The dock site should be available for essentially year-round use and therefore should be free of heavy ice conditions which could preclude docking. The location should likewise be relatively free of adverse high wind conditions which could affect docking.

(c) The dock site should have marine approaches considered safe throughout the entire year.

(d) The pipeline terminus location should desirably have an accessible and relatively level pipeline route leading to the location. Terrain features obviously have a heavy impact on total pipeline costs.

(e) The terminal location should preferably have a large (approximately 1000 acres), relatively flat area for necessary industrial plants and green areas. Additional land should be available for associated industries. Soil conditions at the plant site should be suitable for heavy foundations, without need for piling.

(f) Seismic activity and fault zones, if any, will obviously be a consideration. At this time no special studies have been made, but rather conclusions from past experiences have been given consideration.

(g) The availability and ownership of land at the terminus will ultimately require considerable study; however, the selection of specific site locations is considered premature for this initial study.

(h) It is considered highly desirable that the pipeline terminus plant location be near an existing community which has the basic necessities to support the ongoing operating staff. If little or no community exists within reasonable driving distance, an entire new community with total infrastructure would be required. A new community such as this is an expense that this project could ill afford.

(i) A desirable feature for any potential site would be proximity to existing and adequate freight and human transportation facilities including rail, highway and airport with all-year and all-weather capabilities.

2. Prince William Sound Areas

Two separate areas on Prince William Sound have received evaluations for this report. These areas are in the proximity of Whittier and Valdez. Since the advantages and disadvantages are similar, they will be covered with one set of comments.

(a) Advantages:

Both locations possess deep water close to shoreline and are essentially free of ice on a year-round basis. Marine approaches are considered as safe, but obviously in-depth studies would be required to determine any specific hazards created by the additional shipping into these existing port areas. Both sites have existing basic community facilities with Whittier being more limited than Valdez.

(b) Disadvantages:

The terrain features along potential pipeline routes leading into either site would make construction extremely difficult and expensive. Neither site has the appropriate large relatively flat plant sites. While Valdez has a paved highway to the city, there is no rail. Whittier, which has rail but lacks a highway, has a small airstrip which is less than desirable for heavy airfreight.

3. Point MacKenzie Area

(a) Advantages:

The pipeline routing into the Point MacKenzie Area is one of the best routes considered, and large relatively flat areas are available for plants. While the area is relatively close to the cities of Anchorage, Wasilla and Palmer, a bridge across Knik Arm and a paved highway to the site would be considered necessary to take advantage of the available Anchorage facilities.

(b) Disadvantages:

Water depths close to the shore are inadequate and it is believed that continuous dredging would be necessary to keep a deep water channel open to any dock adjacent to the shoreline. Icing conditions would be the same as experienced in Anchorage.

4. Kenai Area

(a) Advantages:

The area near Nikishka has existing petroleum plant facilities, including a gas liquification plant which has been shipping LNG to Japan since 1969. Water depths of 60 feet are available close to the shoreline. The nearby communities of Kenai and Soldotna have existing facilities desirable for any type of additional plants; however, the fresh water supply in the area must be expanded. Numerous large and relatively flat sites appear to be available for plants. An existing paved highway leads to the area and Kenai has a long paved runway adequate for heavy air traffic on a year-round basis. Other pipelines exist in the area and although the crossing of the Cook Inlet is an expensive undertaking, it would not be the first pipeline crossing of this body of water. Thus this terminus is considered as one of the most potentially desirable.

(b) Disadvantages:

The engineers have been advised that since LNG shipments began in 1969, docking has been delayed on infrequent occasion due to ice or strong southwest winds. Each time delays in docking or loading was a matter of hours rather than days. The impact of additional shipping in the Cook Inlet approaches to this location must receive future analysis, but in comparison with other shipping areas around the world, traffic density is slight and increases are not expected to pose a significant problem.

5. Seward

(a) Advantages:

Seward has deep water closely adjacent to the shoreline and is suitable for year-round marine traffic. The existing community appears to have the basic necessities to support ongoing plant operating personnel. Although there are some relatively flat sites in the area, such sites are very limited, and might be obtainable only with difficulty and high cost.

(b) Disadvantages:

This location would require approximately 50 miles of extra pipeline to reach the terminus and potential routes in the last fifty or so miles would be very difficult and expensive pipelining. The total project cost in comparison with other areas would therefore substantially increase and be a detriment to project economics.

6. West Cook Inlet

(a) Advantages:

The pipeline routing to this area is relatively flat and a crossing of the Cook Inlet would not be required. Deep water is reasonably close to the shoreline. This area should be free of the problem occurring in the Kenai area when the wind is from the southwest. While the large infrastructure investment required would probably make the entire gas pipeline project uneconomic from a private viewpoint, some observers suggest state action to develop the area might allow simultaneous establishment of a coal and gas fed methane industry.

(b) Disadvantages:

There are no sizeable communities in the area, and no roads, railroads and airports exist. The pipeline route from Point MacKenzie to this area traverses swampy terrain and would require several major river crossings. Plant site areas would present foundation problems.

7. Recommended Site:

For the purposes of this initial study which must concentrate on a single site, the engineers have selected the Nikishka area as best suited, in view of the basic requirements and desirable features. If future considerations dictate a change, much of the routing and economics for this site could be transferred to the study of other areas.

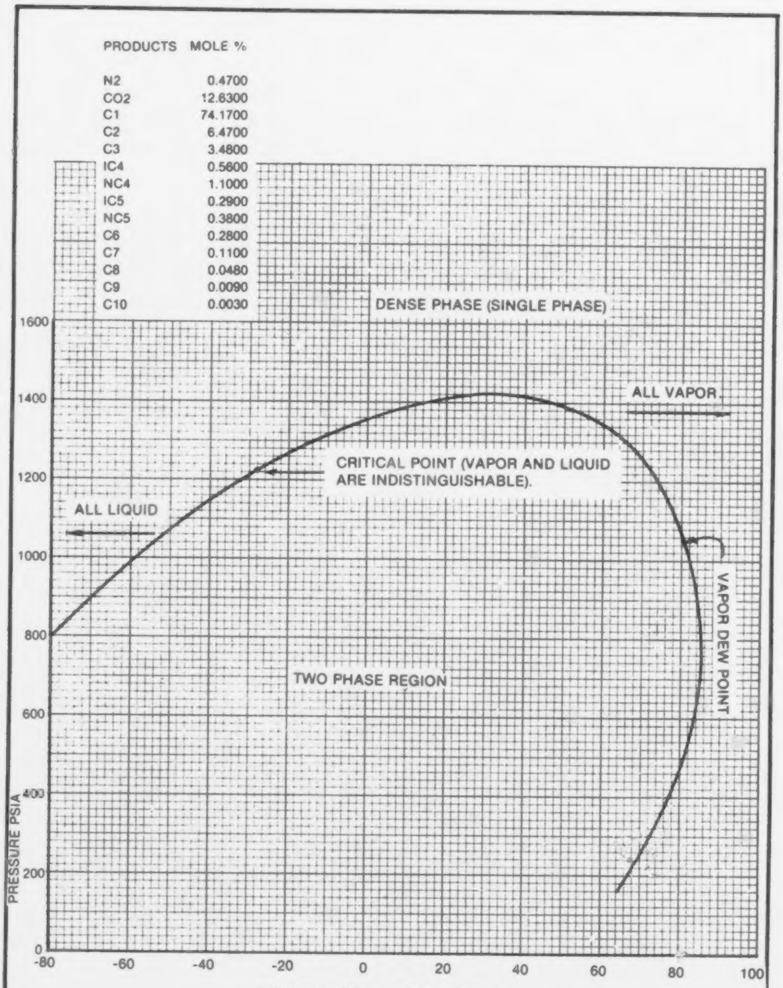
B. NORTH SLOPE FACILITIES

The proposed Trans Alaska Gas System pipeline will be operated at conditions such that only a single gas phase will exist. No gas processing units will be required on the North Slope. The only facilities needed on the North Slope are the existing compressor station and a new refrigeration unit.

1. Compressor Station

The phase envelope of the raw Prudhoe Bay gas is shown in Figure II-A. The highest dew point (retrograde) pressure on the envelope is 1420 psia at 30^{o}F. Some hydrocarbons in the gas will condense at 30^{o}F if the pressure is lower than 1420 psia; therefore, the pipeline must operate at a pressure in excess of 1420 psia. By maintaining the gas pressure above 1660 psig, the pipeline system can be operated with sufficient safety margin to take care of upset conditions and gas composition variations which might affect the phase envelope dew point.

The Prudhoe Bay producers are currently compressing and reinjecting the gas which is in excess of local area fuel



PRODUCTS	MOLE %
N2	0.4700
CO2	12.6300
C1	74.1700
C2	6.4700
C3	3.4800
IC4	0.5600
NC4	1.1000
IC5	0.2900
NC5	0.3800
C6	0.2800
C7	0.1100
C8	0.0480
C9	0.0090
C10	0.0030

TRANS ALASKA GAS SYSTEM

PHASE ENVELOPE PRUDHOE BAY RAW GAS

NOVEMBER 18, 1982

FIGURE II-A

requirements. Discussions with the producers have indicated that there is a likely possibility that the existing compressors could serve as the origin station for this project. Discussions have not included possible financial arrangements. Accordingly, this study does not include the capital cost of approximately one billion dollars for an origin compressor station but does include a unit volume compression charge in the estimate of operating expense.

2. Refrigeration Unit

The pipeline temperature must be maintained below 32°F to prevent melting of surrounding frozen soil. Temperature of the gas as received from the field compressors can be as high as 115°F. Cooling will be accomplished by passing the gas through finned tube forced draft air coolers, followed by typical Freon 22 refrigeration units. During the summer's maximum air temperature periods the air coolers will lower the gas temperature to about 90°F, thus requiring the Freon refrigeration units to have approximately 48,000 installed horsepower for cooling the maximum flow of 2.4 billion standard cubic feet per day of gas to 25°F.

During most of the year when ambient temperatures are quite cold it is estimated that only about 15,000 operating horsepower will be required. Future detail design efforts will optimize the balance between air cooling and Freon refrigeration and are anticipated to provide both capital and operating expense savings compared to the initial values used in this report.

3. Dehydration

The raw gas to the pipeline has been dehydrated by existing triethylene glycol units to 0.445 lb water per million standard cubic feet of dry gas; therefore, it is not likely that a separate new dehydration facility will be required. This corresponds to about a minus 20°F water dew point at 2160 psia. No additional dehydration or treatment of the raw gas will be needed to protect the pipeline from corrosion.

4. Gas Processing Facilities

The proposed system avoids any additional gas processing facilities on the North Slope. The gas processing facilities are still required at the southern end of the pipeline, but the installed cost and operating costs will be much lower than that on the North Slope. In addition, a liquids pipeline estimated to cost in excess of two billion dollars is eliminated.

C. The Pipeline

1. Volumes

The marketability of natural gas is a more important factor in determining economic line size than is a reservoir's production capability. The length of a pipeline also has an important bearing on the volume of gas that can be delivered at a competitive cost of service, or tariff. The longer pipeline, and therefore the more costly, requires a greater throughput volume and higher load factor to remain cost effective. With a reservoir the size of Prudhoe Bay, it is possible to develop a gas line so large that the sudden entry of an otherwise economic volume of gas into the market, even in the late nineteen eighties, could result in its inability to be absorbed within the existing markets at competitive pricing.

With this in mind, the economics of this project are evaluated in three phases, namely:

Phase I: 950 MMSCF/D of raw gas (1 intermediate compressor station)
Phase II: 1,750 MMSCF/D of raw gas (7 intermediate compressor stations)
Phase III: 2,830 MMSCF/D of raw gas (14 intermediate compressor stations)

Note (1) 1 MMSCF/D = 1 million standard cubic feet per day.

(2) Each 1,000 MMSCF/D (1 billion) of raw gas will yield the following approximate volumes of marketable hydrocarbons.

Methane & Ethane (3) (LNG)	774.9 MMCF/D
Propane	21,738 Barrels/Day
Butanes	12,023 Barrels/Day
Pentanes & Heavier	9,996 Barrels/Day

(3) Ethane could be separated and used for petrochemical feedstock.

(4) 1 Barrel = 42 gallons.

It should be noted that while Phase I will transport approximately one third of the ultimate volume studied for Phase III, the investment required will be approximately 60% of the ultimate cost (both based on 1982 dollars).

The key economic element in this type of phase-in of volumes is the time span between phases. A large number of scenarios using different time elements is beyond the scope of this initial study. Accordingly, this study is premised upon two year gaps between bringing each phase on line.

2. Line Sizing

The potential phased growth of this proposed system will be accomplished by adding intermediate compressor stations as market demand increases. Should demand ever exceed the practical maximum capacity of the system with an economic maximum number of intermediate compressor stations, the only option remaining is to install partial or total "loops", or parallel lines. Many major gas transmission pipelines in the lower 48 contiguous states have been expanded through installation of 1 or more loops.

Operating this proposed line at a pressure range of 1660 to 2160 psig provides for a maximum capacity of 2,830 million standard cubic feet per day of raw gas in a 36 inch outside diameter, 0.812 inch wall thickness pipeline when the ultimate 14 intermediate compressor stations are installed. This line sizing is based upon the American Gas Association equation for steady state flow as given below:

$$Q_b = 38.77 \frac{T_b}{P_b}\sqrt{\frac{1}{f}}\left[\frac{P_1{}^2 - P_2{}^2 - 0.0375 \; G \; h \; P_{avg}^2/(T_{avg} \; \mathfrak{z}_{avg})}{GLT_{avg} \; \mathfrak{z}_{avg}}\right]^{0.5} D^{2.50}$$

where:

D = inside diameter of pipe, inches

f = friction factor

G = gas specific gravity, air = 1

L = pipe length, miles

P_1, P_2 = pressure at beginning and end of line segment, respectively, psia

P_{avg} = average pressure of line segment, psia

P_b = base pressure, 14.73 psia

Q_b = flow rate at base conditions, SCF/day

T_{avg} = average temperature of line segment, ^oR

T_b = base temperature, 520^oR

$\mathfrak{z}_{avg}$ = average compressibility of gas, dimensionless

h = elevation difference between ends of line segment, feet

The term $\sqrt{\frac{1}{f}}$ is commonly referred to as the transmission factor which depends on pipe sizes, pipe roughnesses and flow conditions. For fully turbulent flows, it follows the relationship

$$\sqrt{\frac{1}{f}} = 4 \log \left(\frac{3.7D}{K_e}\right)$$

where K_e = effective roughness, inches

For partially turbulent flows, it takes the form

$$\sqrt{\frac{1}{f}} = \left(F_f \;\; 4 \log \frac{Re}{\sqrt{\frac{1}{f}}}\right) -0.6$$

where F_f = drag factor

Re = Reynolds number

$$= 0.0004775 \left(\frac{Q_b \;\; G}{\mu \;\; D}\right)\left(\frac{P_b}{T_b}\right)$$

μ = gas viscosity, lb/ft-sec

Calculations were performed by computer, using Brown & Root's "PIPESIM" gas pipeline computer program. Options selected were:

1. Standing-Katz correlation for the gas compressibility factor
2. Mollier method for compressor sizing
3. Adiabatic compression efficiency = 0.73

The following data values were assumed in the calculations.

P_1 = 2,160 psig

P_2 = 1,661 psig

T_{avg} = $25^{o}F$

= 0.025 CP = 0.0000168 lb/ft-sec

K_e = 0.00021 ft.

F_f = 0.96

3. Operating Pressures

As previously noted, this proposed pipeline system will operate at pressure above the retrograde condensate dewpoint, calculated to be 1,420 psia. An established minimum design pressure somewhat above the calculated dewpoint is desirable to allow for upset operating conditions and changes in gas analysis which might occur in future operational years. The maximum system pressure has been established at 2,160 psig as this corresponds to the maximum operating pressure of valves, flanges and fittings of Class 900 in API Spec. 6D. Pending optimization studies which should be made prior to final design commitments, a compression ratio of 1.3 has been selected. Thus, the intermediate compressor stations will operate with an inlet pressure of $\frac{2160}{1.3} = 1661$ psig.

With the establishment of this maximum design operating pressure the pipe wall thickness proposed for utilization was selected in accordance with ANSI B31.8 code for gas transmission systems. The formula is:

$$P = \frac{2\ St}{D x F x E x T}$$

where:

P = Design pressure, pisg

S = Specified minimum yield strength, psi. For this project API 5LX-70 pipe having S = 70,000 psi has been selected.

D = Nominal outside diameter, inches.

t = Nominal wall thickness, inches.

F = Construction type design factor. The great majority of this pipeline will be Type A with F = 0.72.

E = Longitudinal joint factor = 1.0 for the Submerged Arc Welded pipe selected

T = Temperature derating factor = 1.0 for design temperatures below 250°F.

Using the above formula the calculated wall thickness is t = 0.771 inches. For purposes of this study the next higher standard wall thickness of 0.812 inches has been selected. A heavier wall thickness will be used in a few areas (as yet to be determined) as required by the code.

It should be noted that operation at pressures above retrograde condensate dewpoint permits the transport of the heavier hydrocarbons in the gaseous phase while simultaneously providing for a given volume of throughput to be transported in a smaller diameter line that would be required for a lower pressure line.

As a comparison, this proposed 36" line operating at the maximum 2,160 psig pressure will have approximately the same throughput capacity as a 48" line operating at 1,260 psig. Although higher pressures require a greater pipe wall thickness when utilizing identical pipe grade, the following comparison is of interest.

36" x 0.812 wall 5LX-70 requires 805 tons steel per mile.
48" x 0.600 wall 5LX-70 requires 880 tons steel per mile.

4. Operating Temperatures

Worldwide pipeline builders have for many decades been confronted with the decision to fully bury or place above ground a proposed pipeline. Many in-depth optimization studies have been made on this subject matter. Without benefit of such studies those individuals without extensive pipeline experience often assume that an above ground pipeline will represent a lower investment. In-depth studies usually prove the opposite is correct. For this project, studies should compare considerations of materials, construction, and maintenance of each type system.

For example, the thermal effects on the pipeline with each system must be evaluated. A fully buried pipeline experiences minimal thermal change, whereas with an above ground pipeline it is necessary to allow for expansion and contraction. This creates the necessity for either expansion loops or above ground directional changes accomplished by movement of the pipe on the support members. Such support members are relatively closely spaced and directly slow the rate of progress of construction. The support members are complex and expensive structures.

A buried pipeline is restrained by the surrounding earth, whereas an aboveground line must be anchored at regular and frequent intervals. Such anchors are large and expensive. In areas where the flowing gas temperature must be maintained below 32°F, pipe insulation would be required due to summer ambient air temperatures. Insulation often costs more than the pipe. Above ground pipelines are usually more expensive to maintain due to an exposure to the elements, mobile equipment and even sabotage.

In an arctic environment the considerations are more complex than in southern areas. Since an optimization study is beyond the scope of this initial study, the engineers have used past experience in deciding that only a fully buried line will be considered for this study.

In areas of permafrost a buried line must either (1) operate at or near the soil temperature or (2) be totally insulated to the extent necessary to prevent heat transfer from the pipeline to the surrounding soil. In areas of discontinuous permafrost the potential for frost heave must be recognized.

Accordingly, the conceptual design and economics of this study are based upon refrigerating the gas as received at a maximum Prudhoe temperature of 115°F down to 25°F, plus removing the heat of compression at each intermediate compressor station in order to maintain the 25°F flowing temperature. The engineers foresee potential cost reductions in both the capital and operating cost estimates as used for refrigeration in this initial study but recognize that any such savings must require confirmation through in-depth studies which are beyond the current scope.

5. Pipeline Route

The proposed gas pipeline system parallels the Alyeska Oil Pipeline from Prudhoe Bay to a point south of Livengood, and at that point passes through a valley west of Fairbanks to an intersection with the Fairbanks/Anchorage highway, then it parallels the highway as far as milepost 696. At this point the pipeline route continues south whereas the highway turns in an easterly direction toward Palmer. The pipeline crosses the Cook Inlet to the Point Possession area, then follows the coastline to the terminus at Nikishka. Overall the pipeline covers 820 ± miles in the route between Prudhoe Bay and tidewater.

(a) Summary of land ownership (approximate)
The land along the route is owned by several agencies and/or groups, and is summarized as follows:

Estimated Ownership	Miles	%
Federal Land	415	51
State Highway Department	223	27
Alaska Railway	68	8
Private Land	5	1
Native Land	8	1
State Land	36	4
Borough Land	50	6
Marine Crossing	15	2
	820	100

(b) Route from Prudhoe Bay, Alaska
The first one hundred (100) miles of the pipeline route is aligned primarily in the flood plain of the Sagavanirktok River. This alignment helps to take advantage of the relatively low ice content gravels in the flood plain and the areas which are thawed by the waters of the river.

The first 12 to 15 miles of the alignment will be placed in ice-rich silt in the upper 10 feet of the soil. Nearly pure ice in the form of wedges, probably up to 20 feet, is a prominent feature of this portion of the route. Similar soil conditions are predominant on the Arctic plains and typify the general permafrost conditions in northern Alaska.

The second one hundred (100) mile segment of the route was also selected to place the line in thawed or low content frozen soils, preferably of granular type. This will be accomplished by following the flood plains of the Sagavanirktok River to the mouth of the Atigun River, then the Atigun River to the Continental Divide at the Dietrich Pass. From the Divide, the route follows the Dietrich and Koyukuk Rivers.

An alternate within this section has been investigated which would permit rerouting of the pipeline to a location west of the point where Alyeksa's Pipeline crosses the Continental Divide. At the point where Alyeska's Pipeline turns east and leaves the Atigun River the Trans Alaska Gas System's alignment will follow the Atigun River to a point of origin near the Continental Divide. At the headwaters of the Atigun River the alignment turns to the east-southeast and joins with the original Alyeska alignment at a point two miles south of Atigun Pass.

The alignment continues south from the Continental Divide along the Koyukuk River to approximate milepost 240. The route is determined principally by the confines of the Koyukuk Valley and the location of the thawed soil and ice-poor gravels in frozen sections. From this point to the Yukon River the general alignment is determined by the location of the Yukon River Crossing. Most of this portion is through permafrost, with the soil condition becoming generally more severe toward the south. In this section the route crosses hilly terrain with a variety of soils, including gravel, rock and ice rich silts.

The Yukon River is the second largest water crossing and one of the most important along the route. It is a major migrating stream for anadromous fish and it experiences a high incidence of ice jams coupled with accelerated scour. If it is not possible to locate the pipeline on the existing highway bridge across the Yukon River, a proposed crossing point in Rampart Canyon will permit burial in bedrock for maximum security.

In comparison with the northern section of the alignment, the ground profile between the Yukon River and Kenai tends to be more gentle, and the climate warmer on the average, but subject to wider extremes. Higher ground temperatures result in increased sensitivity of the soil to thermal disturbance. The most severe permafrost problems along the pipeline route are encountered in the Tolovana uplands section. These conditions generally decrease in severity to about milepost 470, where thawed soil becomes prevalent.

The basic route proceeds through a valley west of Fairbanks to Dunbar where it intersects with the Alaska Railroad. The land in the area from Fox to Dunbar is generally wet muskeg with low soil bearing values. Accordingly, the line route will basically follow the ridge line on the eastern edge of this swampy area.

Figure II-B shows two possible ways of bringing the pipeline closer to Fairbanks. Routing the main pipeline further east to meet the Alaska Railroad at Fairbanks is one possibility. A spur line from the main pipeline to any plant which might take from the gas stream would be substantially cheaper. Proximity of all three routes to Fairbanks industrial sites, the North-Star Borough boundary, and a proposed Methanol facility are shown on the map.

The Tanana River crossing at Nenana will be expensive; however, the possibility of using the Alaska Railroad bridge for this crossing will be evaluated during future studies.

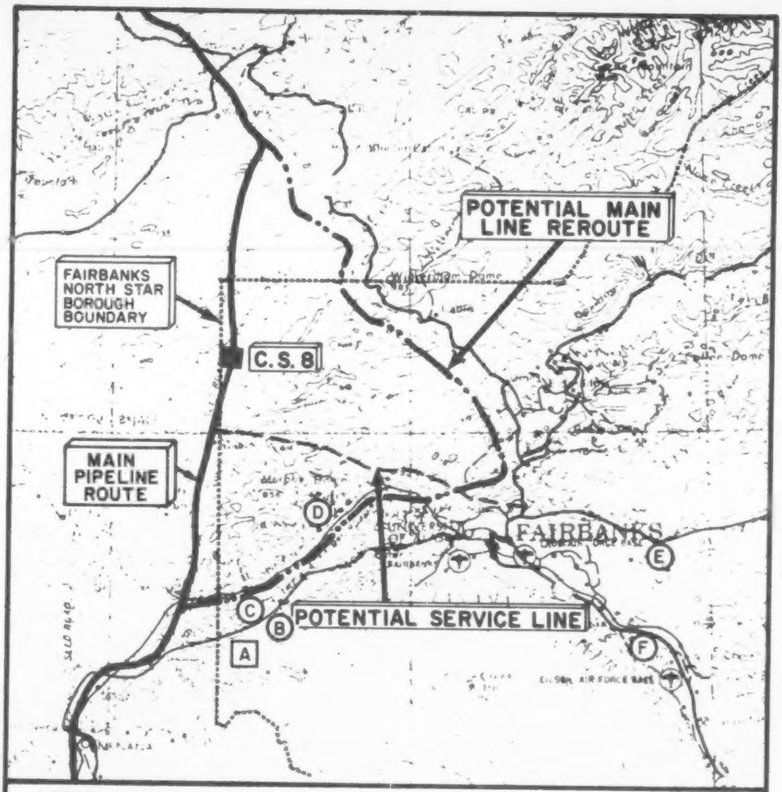
From Nenana the route goes south in a broad river drainage area which is basically gravel; however, there is the occasional spot of permafrost. There is the option of utilizing either the highway or railway company right-of-way between Nenana and Liaho.

The route follows the highway right-of-way from Liaho to and through the McKinley National Park and continues along the east side of the highway, using it as a buffer against the Nenana River from McKinley Park to Summit. Summit is the high point on the line south of Fairbanks, and there is a gentle decrease in elevation from here to tidewater.

After Summit, the route goes in a southwesterly direction through a broad valley, which has some gravel; however, indications are there is permafrost through this area. Generally, the highway right-of-way is followed, and at milepost 600, Hurricane Gulch is crossed. The Chulitna River will be crossed at milepost 638 with a conventional buried crossing.

The route goes south from the McKinley area through the Susitna Valley. This area generally follows the highway right-of-way, and it is well drained as evidenced by the size of trees growing here.

At milepost 696 the proposed pipeline route leaves the highway right-of-way heading in a southerly direction. The route diverts around the edge of Nancy Lake Recreation area and heads directly towards the Figure


POTENTIAL MAIN LINE REROUTE
FAIRBANKS NORTH STAR BOROUGH BOUNDARY
C.S. 8
MAIN PIPELINE ROUTE
D
FAIRBANKS
E
C
B
POTENTIAL SERVICE LINE
A
F
EIELSON AIR FORCE BASE

NOTES:

1. MAIN PIPELINE ROUTE (APPROX. 47 MILES)
2. POTENTIAL MAIN LINE REROUTE (APPROX. 79 MILES)
3. POTENTIAL SERVICE LINE (APPROX. 32 MILES)
4. SITE OF PROPOSED ALASKA INTERIOR RESOURCES CO., INC. (METHANOL FACILITY)
   - [A] TANANA SITE
5. SITES OF INDUSTRIAL DEVELOPMENT SELECTED BY FAIRBANKS NORTH STAR BOROUGH STUDY
   - (B) BONANZA SITE
   - (C) OHIO CREEK SITE
   - (D) MARTIN SITE
   - (E) TWO RIVERS SITE
   - (F) MOOSE CREEK SITE

TRANS ALASKA GAS SYSTEM

FAIRBANKS ALTERNATE

NOVEMBER 18, 1982

FIGURE II-B

Eight Lake area, which lies immediately north of Cook Inlet.

The route has a 15 mile marine crossing from the Figure Eight Lake area to Pt. Possession.

From the Pt. Possession area, the pipeline follows an existing oil pipeline right-of-way in a southwesterly direction, a distance of 55 miles to the Kenai area. This is flat, wet land; therefore, construction must be done during the winter season. The land on the Kenai Peninsula is owned by the Borough, State of Alaska, Alaska native corporations and private individuals.

6. Benefits of Route

(a) The expenditure of considerable sums of money during construction and ongoing operation of any industrial facility quite naturally provides an economic boost to any nearby community. Cities and communities along this proposed pipeline route include:

Fairbanks
Nenana *
Anderson *
Clear *
Sealy *
Cantwell *
Summit *
Talkeetna
Willow *
Wasilla *
Palmer
Anchorage
Kenai
Soldotna

* Less than 20 miles from a compressor station.

Typically, a pipeline of this length will employ personnel at an operations headquarters, two or more maintenance centers, and at each of the 14 compressor stations.

(b) This proposed pipeline route is within established transportation corridors for approximately 90% of its length.

For that portion of the route from near Dunbar to about Willow the established railroad and highway will prove to be a major asset to pipeline construction and operation.

The Alaska Railroad is ideally located to transport substantial portions of the 660,000 tons of pipe to be used, plus other project equipment and supplies. Obviously, the proximity of the pipeline route to Highway 3 will benefit both project logistics and the economic health of the communities on the highway.

D. COMPRESSOR STATIONS

Fourteen pipeline compressor stations are suggested for the ultimate volume in the Trans-Alaska Gas System. The number of compressor stations and mile post locations are based on preliminary computer hydraulic analysis only. Specific sites, when studied for terrain, land ownership and other factors may require significant changes in the overall gas pipeline and compressor system.

The compression and gas handling equipment recommended includes the gas turbine driven centrifugal compressor and stand-by unit, all compressor plant ancillary equipment, gas separators, gas refrigeration facilities, turbine fuel system, gas plant piping system, plant monitoring and control system, and compressor building.

Although the two 100 percent capacity compressor unit plan is more costly for the initial one billion SCFD phase of the Trans-Alaska Gas System, this plan is recommended in this initial study in view of saving in investment that can be achieved when volumes increase to maximum line capacity of Phase III, simplicity in operation and the fact that this size of gas turbine driver is in a highly competitive size range, is well developed and has a documented history of reliability.

The suggested compressor station also includes plant offices, control and telecommunications room, power generation, plant heating system, maintenance shops, garage, potable and fire water systems, sanitary sewage, trash handling and incineration systems.

For the purpose of this report, personnel accommodations have been included at every pipeline compressor station regardless of the probability that a residential area may exist within a reasonable distance from one or more of the tentatively located compressor stations. These accommodations consist of single occupancy dormitory rooms with bath; a complete food preparation unit with dining, lounge, game area, laundry and linen storage area; and an emergency clinic facility.

General plant area facilities include streets, walks, area and perimeter lighting, fencing, propane, fuel oil, automotive fuel and lubricating oil storage and handling systems.

The compression of natural gas at each compressor station along the pipeline will create an increase in the gas temperature. This heat of compression must be removed wherever it is essential to maintain the pipeline below 32°F. Accordingly, gas cooling units will be installed at the discharge side of compressor stations. As the pipeline progresses to more southern portions of the route, it may be possible to eliminate some cooling units. However, since this possibility can only be determined through extensive studies, this report includes this costly item at each compressor station.

The wide variations between summer and winter ambient air temperatures along the pipeline's 820 mile length will create variable operating conditions. Accordingly, the cooling units will consist of finned tube, forced draft air coolers and Freon 22 refrigeration units. Dependent upon final design optimization, the air coolers can bring the temperature to within approximately 25°F of ambient air temperature. Air coolers are less expensive to operate than refrigeration units, and during winter months they will provide adequate gas cooling without operation of the refrigeration units.

Operation of the air coolers during the hottest days of summer could add temperature to the gas and thus must be bypassed to direct the gas through the refrigeration units. There are certain air temperature ranges wherein the operation of both air coolers and refrigeration will be advantageous. Complete automation of this operation as air temperature varies will maintain a constant temperature of the gas in the pipeline.

E. TIDEWATER PROCESSING FACILITIES

The proposed pipeline starts on the North Slope and terminates at tidewater. The gas processing facility at tidewater assumes that 2.83 billion standard cubic feet per day of Prudhoe Bay gas is available to the pipeline. The product rates contained in the gas stream arriving in Kenai are shown below, (2.704 BSCFD before deduction for plant fuel).

Products Before Fuel	BPD 60°F	MMSCFD	Higher Heating Value MMBTU/HR.
LNG (HHV = 1064 BTU/SCF)		2,193	97,232
Propane	61,518		9,869
i-Butane	11,763		2,052
n-Butane	22,263		4,042
Pentanes Plus	28,288		5,640
TOTALS	123,832	2,193	118,835

Estimated Plant Fuel = 10% of HHV of LNG Products

Processing facilities at tidewater might include units for NGL extraction, fractionation, CO_2 removal, dehydration, LNG production, petrochemicals production, product storage and loading. (Figure III-C) The final selection of NGL recovery and gas treating process schemes is out of the scope of this preliminary study; however the selection of process schemes will not significantly impact the economics of the overall TAGS system.

1. NGL Extraction, Fractionation, CO_2 Removal, Storage and Loading

The tidewater processing steps are shown in block diagram form on Figure II-C. The natural gas received at the tidewater plant has not been processed on the North Slope and it contains 12.7% CO_2 and various hydrocarbon components. For LNG production, CO_2 content of the gas stream must be significantly reduced to avoid solid formation in the processing facility.

Propane and heavier hydrocarbons can normally be sold as liquid products at higher values per pound than as a natural gas product. Essentially all these components are recovered in an NGL extraction unit consisting of a cryogenic expander type plant. This unit effectively uses the high pressure available in the plant inlet gas to recover horsepower and refrigerate the gas to condense liquids as the gas expands to lower pressure.

The bulk CO_2 in the natural gas is removed in this part of the plant and the gas is also dehydrated to prevent freeze-ups in the expander unit. For this initial study, the CO_2 removal unit utilizes the Benfield activated carbon process.

The CO_2 gas from the CO_2 removal unit will contain trace quantities of hydrocarbons and hydrogen sulfide. Possible disposition of the CO_2 stream includes petrochemical feedstock, spiking with hydrocarbons to produce low BTU fuel, tertiary oil recovery or venting to atmosphere in tall stacks.

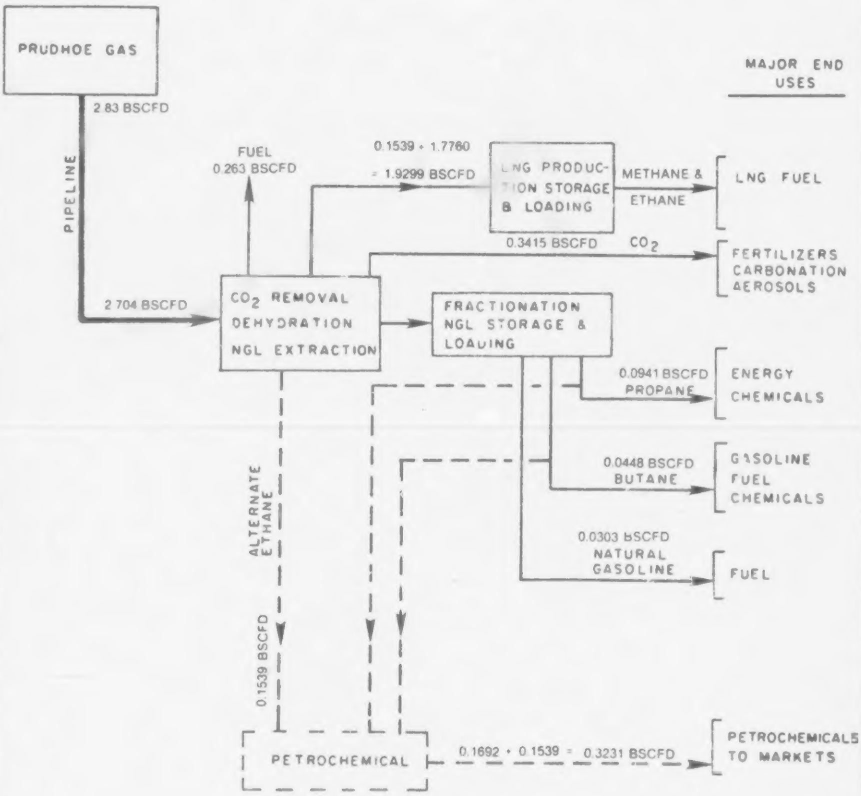
The propane and heavier hydrocarbons recovered from NGL extraction unit are then routed to the fractionation unit. In the fractionation unit, the NGL liquid stream is split into propane, butanes and natural gasoline. The treated gas from the NGL extraction unit, which is basically methane and ethane, is then routed to the LNG unit for LNG production.

Product storage and loading facilities will be required for the units mentioned above. There will be six refrigerated atmospheric pressure storage tanks of various sizes, and two ship loading berths required to service this phase of the operation.

2. LNG Unit

The LNG unit consists of dehydration, liquefaction, storage and loading sections. Small amounts of CO_2 and water remain in the gas from the NGL extraction facility. The treated gas from the NGL extraction unit is routed to a dehydration section where water vapor and remaining CO_2 are essentially all removed. The dehydrated gas is then cooled and liquefield. The LNG is stored in tanks for shipment in LNG tankers.

Ethane could also be used as a petrochemical feedstock instead of being sold in the LNG product. A different processing scheme would be developed to produce an ethane product.


PRUDHOE GAS
MAJOR END USES
2.83 BSCFD
PIPELINE
FUEL 0.263 BSCFD
0.1539 + 1.7760 = 1.9299 BSCFD
LNG PRODUCTION STORAGE & LOADING
METHANE & ETHANE
LNG FUEL
0.3415 BSCFD
CO2
FERTILIZERS CARBONATION AEROSOLS
2.704 BSCFD
CO2 REMOVAL DEHYDRATION NGL EXTRACTION
FRACTIONATION NGL STORAGE & LOADING
0.0941 BSCFD PROPANE
ENERGY CHEMICALS
ALTERNATE ETHANE
0.0448 BSCFD BUTANE
GASOLINE FUEL CHEMICALS
0.0303 BSCFD NATURAL GASOLINE
FUEL
0.1539 BSCFD
PETROCHEMICAL
0.1692 + 0.1539 = 0.3231 BSCFD
PETROCHEMICALS TO MARKETS

THRU PUT VOLUMES PHASE III

12% FUEL IS TAKEN FROM LNG PRODUCT AND EQUALS APPROXIMATELY 10% OF LHV INLET.

DASHED LINES INDICATES ALTERNATE FEEDSTOCK ROUTE.

SOLID LINES INDICATE UNITS INCLUDED IN THIS REPORT COST ESTIMATE.

Brown & Root, Inc. PIPELINE ENGINEERING HOUSTON, TEXAS	CONT. NO.
TRANS ALASKA GAS SYSTEM **THRUPUT VOLUMES**	DWG. NO. FIGURE II-C
BY CHECKED JEC APPROVED J. Branch DATE 11/8/82	PAGE OF

II. SOCIO-ECONOMIC ASPECTS OF PROJECT

A. Project Potential Timetable

1. General:

Provided all governmental permits and project financing are obtained expeditously during the period of initial engineering, the system can go on stream approximately five years after commencement of activities as shown on the accompaning chart. As noted on the chart, the schedule for Phases II and III which are dependent upon projected market contracts is acomplished without shutdown of activities.

Maintaining such a schedule on a project of this magnitude is dependent upon many variables and is therefore difficult to project. Much will depend upon the worldwide economic climate during materials purchasing and system construction in the middle of the decade of the 80's. When this report was prepared all required materials, equipment and construction contractors were readily available on a highly competitive basis. Accordingly, current conditions indicate that cost and time elements used in this report are considered to be conservative and achievable.

2. Cost Control

Although effects of monetary inflation are beyond the control of this project, maintenance of human discipline from government, management and labor is such a critical aspect of ultimate total project cost that efforts toward control must be established.

Comparison of the Alyeska Pipeline in Alaska with the East-West Crude Oil Pipeline in Saudi Arabia presents an interesting example. Both projects are of the same diameter, length and capacity, and required similar pump stations, tankage, marine loading, access roads and airstrips. Both are remote from industralized manufacturing areas and large population centers which provide local labor. Both required construction camps and heavy logistic support. Both traversed mountains and level terrain. Since the Alyeska pipeline cost was approximately five times that of the Saudi pipeline, the question "why" must obviously be considered.

Certainly a portion of the difference can be attributed to climatic conditions. Additionally, in an admirable effort to protect the environment, perhaps the Federal and State governments created a mental atmosphere that ignored economic reality. Perhaps management, in their eagerness to market the tremendous crude oil reservoir at Prudhoe, too willingly accepted any and all government intervention and regulation. Perhaps labor was guilty of taking advantage of the existing economic times by making unreasonable demands. Nevertheless, whether the high costs of development in Alaska are due to any or all of these reasons, all entities associated with the project should be aware of the following factors that influence cost:

a. Cooperation with government

Government is due some of the blame for the expensive delays and failures of recently proposed energy transportation projects such as the PACTEX and Northern Tier Oil Lines, the Pt. Concepcion Pac-Alaska LNG receiving facility and, if this project is necessary, ANGTS. The "incentive rate of return (IROR)", "one-stop permitting process" of the Federal Inspector and other "experiments" did not create a strong enough atmosphere to keep costs down in the regulatory process. Accordingly, much stronger discipline is necessary.

b. Use of the learning curve

The Alyeska Oil Pipeline was a pioneering effort. Many challenges of arctic construction, new at the time, were met. Another pipeline effort, it can be assumed, can take advantage of the efficiencies of the "learning curve" not only due to the Alyeska experience but from ten more years of Arctic development since the last pipeline was built.

c. Labor agreements

Expectations, based on fact or not, are that a pipeline boom brings extraordinary wages and working conditions; this one might. At the same time, labor-saving advances in technology, such as automatic welding, should be given economic consideration in the field. Discipline in keeping labor costs controlled is essential.

d. Management discipline

Contingencies have been included in the cost projections for this study, but management must use every control tool available to it to minimize the utilization of such contingency funds.

B. Economic Significance to Alaska

1. Employment

In the area of employment the state of Alaska would benefit in two ways.

a. Construction

Previous Alaskan pipeline projects have historically created a large number of construction related jobs. It is important to point out that under the present proposal TAGS would be constructed in a phased approach. The total phase time period would offer construction employment opportunities specifically related to the pipeline project over a nine year period. This is viewed as a major advantage because it controls the construction employment period and reduces the dramatic effect of a short-term employment cycle. The phased approach allows for a more sustained employment benefit. Initial estimates indicate the following approximate man-months of labor will be required for construction:

Pipeline	65,000
Compressor Stations	100,000
CO_2 Removal, Dehydration and NGL Extraction	35,000
LNG Plant	110,000

b. Operations

With the raw gas stream at a tidewater terminus the potential for development of a petrochemical industry exists. Employment opportunities which accompany petrochemical development are viewed as extremely stable and offer excellent long-term advantages to both the community and state. Along with the long-term employment opportunities generated through petrochemicals, the pipeline itself would require a number of operation and maintenance personnel. Historically it is indicated that operations of this magnitude will provide permanent employment as follows:

Pipeline	150
Compressor Stations	100
CO_2 Removal, Dehydration and NGL Extraction	85
LNG Plant	100

c. Associated Job Creation

The creation of new permanent jobs in Alaska will reach far beyond the manpower required to operate the proposed pipeline and hydrocarbon processing facilities. Alaskan employment will benefit from the increased demand in goods and services to maintain the pipeline system and those directly employed by it. This will include expansion of existing services along with growth in local production of goods and services previously supplied from outside of Alaska.

Data supplied by the U.S. Bureau of Labor Statistics indicates that for every 100 operating jobs in the pipeline and hydrocarbon processing industries, an average of another 90 to 130 jobs will be required locally to support the daily needs of the equipment and the workers. The harsh climate of Alaska could skew these numbers even higher.

New jobs will likely appear in a variety of areas. New offices, processing plants, and homes will require expanded gas, electric, and water services. Trade growth from the sale of pipeline products as well as goods at the retail level will open new positions, and rail, water, truck, and air transportation will expand to handle this trade. Local computer and communication services will be required to meet the needs of the modern pipeline and processing plants.

Machine shops will likely appear near the processing plants to repair or remanufacture motors, pumps and valves. Insulation requirements for maintenance of the pipeline, compressor stations, and plant may be great enough to support local manufacture. Personal services such as banking, real estate, baking, entertainment, medical services, etc. will be required. Finally state and local government will grow in proportion to the growth in population and tax revenues.

2. Other Economic Benefits
   a. Best Use of the Resource

The development of a possible liquids extraction facility, fractionation plant, and petrochemical manufacturing at a tidewater location promises to maximize the best possible useage of valuable gas liquids. In contrast to other approaches where gas liquids are considered strictly on a

BTU value basis, the TAGS approach provides the potential for processing within the State gas liquids such as ethane and propane for a higher return in the final form of petrochemical byproducts.

b. Source of Gas for Local Consumption

As proposed, the Trans Alaska Gas Pipeline has the potential of supplying a source of natural gas for local consumption. The terminus location of the pipeline could definitely be supplied with natural gas. In addition to this, side valves could be provided at any location along the pipeline route where an economically justifiable need for the gas may exist. It should be pointed out, however, that the raw gas stream as transported in the pipeline is not suitable for utilization as fuel without certain processing.

c. Access to Hydrocarbons

As a result of the proposed project all unprocessed North Slope hydrocarbons would remain inside the state of Alaska, thereby offering the potential for instate petrochemical development. The establishment of hydrocarbon processing offers a wide variety of byproducts ranging from plastics to fertilizers. The instate manufacturing of these byproducts has the added benefit of satisfying local Alaskan markets at a potential savings.

C. Comments on Environmental Aspects

No Environmental Impact Statement (EIS), nor even environmental studies have been conducted for the preparation of this initial report. Cost allowances for future studies have been included in the cost estimates presented in this report.

A few general comments are considered appropriate to this initial study. From the Prudhoe Bay area to a point near Livengood, the pipeline closely parallels the crude oil pipeline and is within an established corridor. No new or surprise elements affecting the general environment along this route would be anticipated to result from this new line. At the Livengood area, the pipeline departs and goes through a basically virgin terrain area to near the railroad siding of Dunbar. The environmental impact in this area must be evaluated in future efforts.

At Dunbar, the pipeline route enters a well established corridor containing the Alaska Railroad and State Highway No. 3. Since this is an established transportation corridor, it is not anticipated that the pipeline will present any significant impact. At a point near Willow, the pipeline again leaves the established corridor and traverses the Point McKenzie general peninsular area which basically can be characterized as a virgin wilderness area. At this point, the pipeline crosses the Cook Inlet to near Point Possession. Although there have been other pipelines in the Cook Inlet, no prior line is in this exact location and it is recognized that future studies must be made to determine any environmental impact. From Point Possession to the Nikishka area, the pipeline would closely parallel existing pipelines. At Nikishka several petroleum plants currently exist and the proposed additional plants will present similar types of operations.

D. Capital Investment

1. Basis

The cost of the pipeline and associated compressor and refrigeration stations for this project has been estimated on a "conceptual design" basis. By definition, conceptual design is based on ideas of both the client and the engineers, experience of similar projects, historical data and partial information. While this initial study presents an estimated cost for a technically feasible plan, it does not include the in-depth design, investigations and optimization studies considered essential to obtainment of project financing. Accordingly, the following facts should be recognized when reviewing the cost estimates:

(1) All costs are based on 1982 conditions without allowance for future inflation.

(2) Detail specifications and firm quotations were not utilized; prices are based on recent experience and discussions with suppliers.

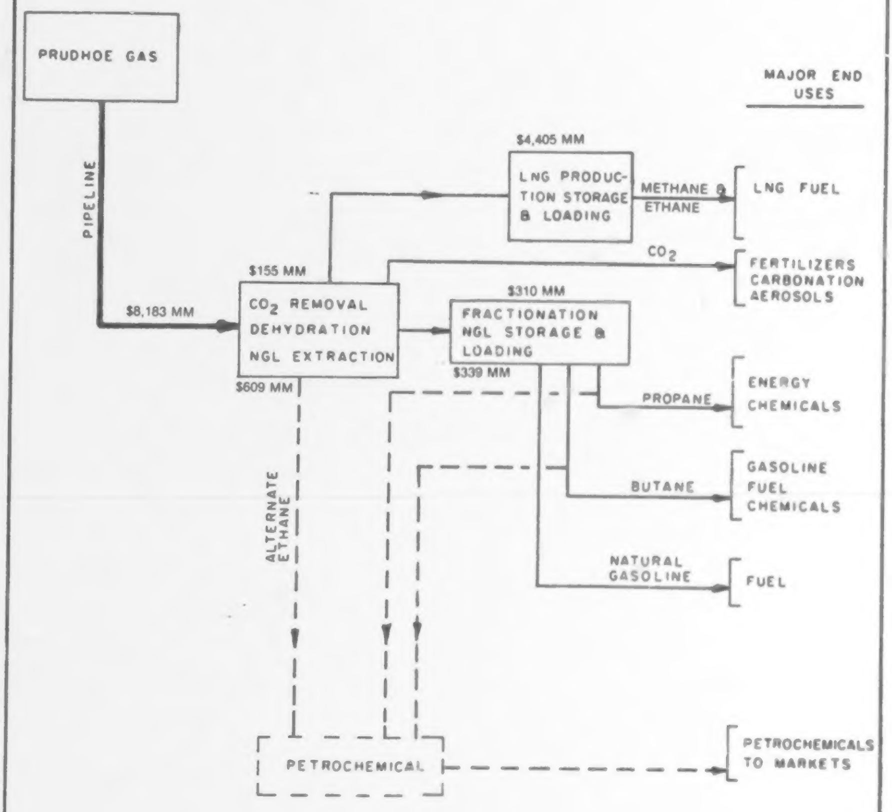
(3) Capital and operating costs are based on numerous assumptions, which though considered as valid must obviously be confirmed by more comprehensive studies.

(4) All costs include engineering, project management, and a 20% contingency.

2. Estimates of Capital Cost

CUMULATIVE TOTAL MM $

	PHASE		
ITEM	I	II	III
PIPELINE, COMPRESSOR STATIONS AND REFRIGERATION	$ 4,548	$ 6,216	$ 8,183
CO_2 REMOVAL	76	117	155
NGL EXTRACTION	302	463	609
NGL FRACTIONATION	147	225	310
NGL STORAGE & LOADING	167	167	339
LNG PRODUCTION & STORAGE	1,640	2,772	4,405
DOCK FACILITIES	193	193	193
ORGANIZATION COST	100	100	100
TOTAL PROJECT	$ 7,173	$10,253	$14,294


PRUDHOE GAS
MAJOR END USES
PIPELINE
$4,405 MM
LNG PRODUCTION STORAGE & LOADING
METHANE & ETHANE
LNG FUEL
$155 MM
CO_2
FERTILIZERS
CARBONATION
AEROSOLS
$310 MM
$8,183 MM
CO_2 REMOVAL
DEHYDRATION
NGL EXTRACTION
FRACTIONATION
NGL STORAGE &
LOADING
$339 MM
$609 MM
PROPANE
ENERGY
CHEMICALS
ALTERNATE ETHANE
BUTANE
GASOLINE
FUEL
CHEMICALS
NATURAL GASOLINE
FUEL
PETROCHEMICAL
PETROCHEMICALS TO MARKETS

ACCUMULATED COST PHASE III

DASHED LINES INDICATES ALTERNATE FEEDSTOCK ROUTE.

SOLID LINES INDICATE UNITS INCLUDED IN THIS REPORT COST ESTIMATE.

Brown & Root, Inc. PIPELINE ENGINEERING HOUSTON, TEXAS	CONT. NO.
TRANS ALASKA GAS SYSTEM **CONSTRUCTION COSTS**	DWG. NO. FIGURE II-D
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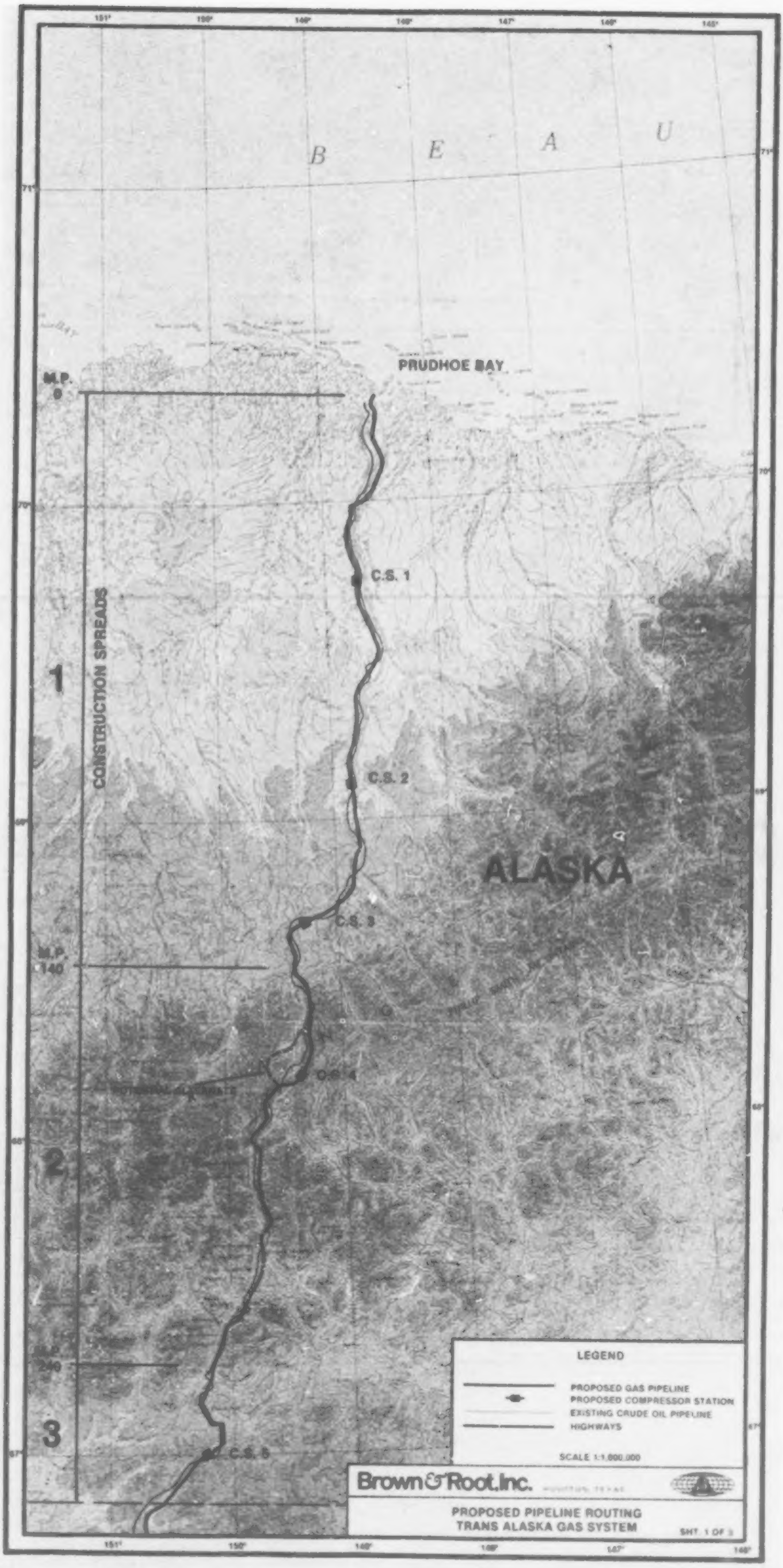
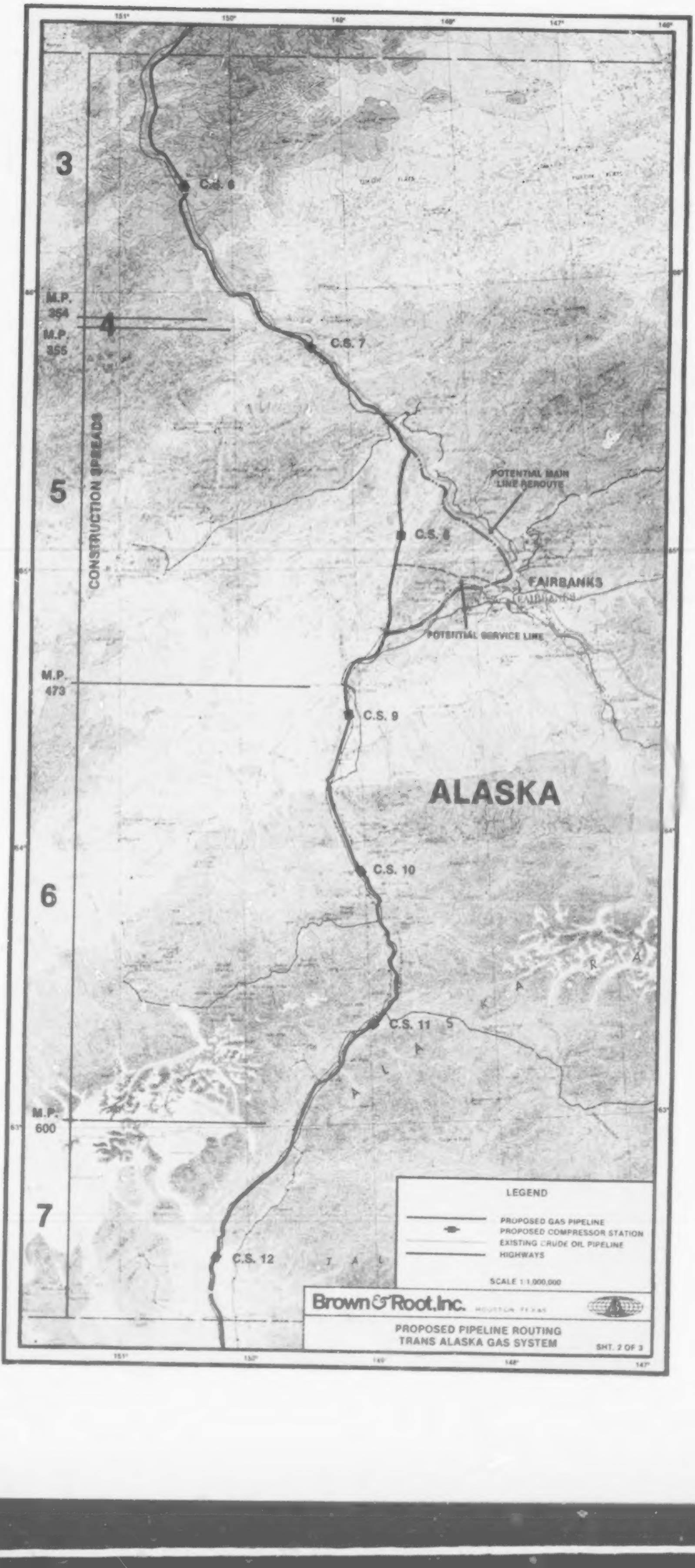

151°
150°
149°
148°
147°
146°
145°
B E A U
71°
PRUDHOE BAY
M.P. 0
70°
C.S. 1
CONSTRUCTION SPREADS
1
C.S. 2
69°
ALASKA
C.S. 3
M.P. 140
C.S. 4
68°
2
M.P. 240
3
67°
C.S. 5
LEGEND
PROPOSED GAS PIPELINE
PROPOSED COMPRESSOR STATION
EXISTING CRUDE OIL PIPELINE
HIGHWAYS
SCALE 1:1,000,000
Brown & Root, Inc.
HOUSTON, TEXAS
PROPOSED PIPELINE ROUTING
TRANS ALASKA GAS SYSTEM
SHT. 1 OF 3


151°
150°
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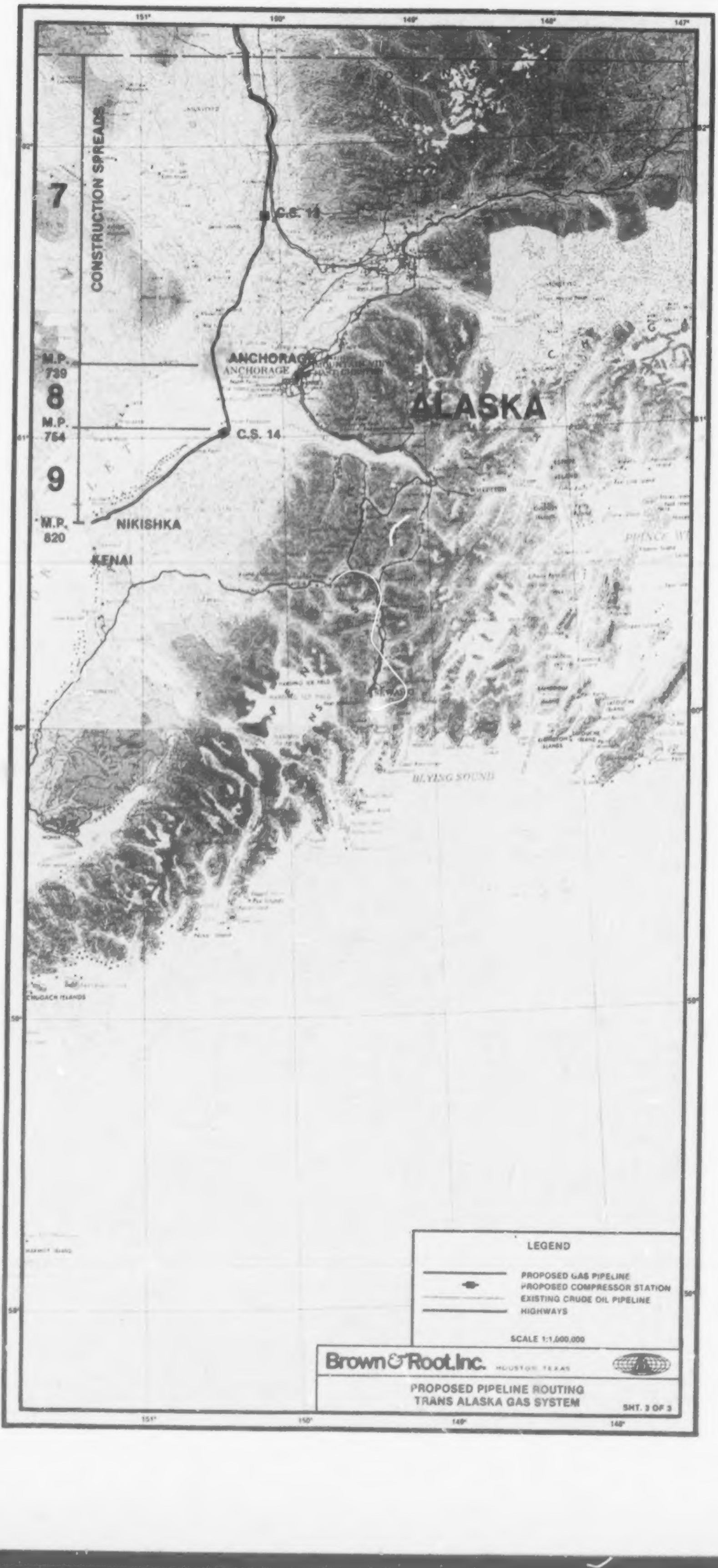
146°
3
C.S. 6
M.P. 354
4
M.P. 355
C.S. 7
CONSTRUCTION SPREADS
5
POTENTIAL MAIN LINE REROUTE
C.S. 8
FAIRBANKS
POTENTIAL SERVICE LINE
M.P. 473
C.S. 9
ALASKA
C.S. 10
6
C.S. 11
ALASKA RANGE
M.P. 600
7
C.S. 12
LEGEND
PROPOSED GAS PIPELINE
PROPOSED COMPRESSOR STATION
EXISTING CRUDE OIL PIPELINE
HIGHWAYS
SCALE 1:1,000,000
Brown & Root, Inc.
HOUSTON, TEXAS
PROPOSED PIPELINE ROUTING
TRANS ALASKA GAS SYSTEM
SHT. 2 OF 3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EXISTING CRUDE OIL PIPELINE
HIGHWAYS
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Brown & Root, Inc.
HOUSTON TEXAS
PROPOSED PIPELINE ROUTING
TRANS ALASKA GAS SYSTEM
SHT. 3 OF 3

ECONOMIC ANALYSES

The information and assumptions contained herein are based in part on the advice of and information supplied by the Staff of the Committee and its advisors. The information contained herein is believed reliable but Dillon Read makes no warranty or representation with respect to the accuracy or completeness of the information or that of the opinions based thereon, nor does Dillon Read assume any liability with respect to the use of or for damages resulting from the use of any information, method, process or opinions disclosed in the analyses.

Dillon, Read & Co. Inc.

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TRANS-ALASKA GAS SYSTEM:
ECONOMIC ANALYSES

Summary and Conclusions

Introduction

Dillon, Read & Co. Inc. has been asked by the Governor's Economic Committee on North Slope Natural Gas (Committee) to review the prospective economics of the proposed Trans-Alaska Gas System (TAGS or System). The economic analyses undertaken herein examine on an initial basis the prospective economics of the System including the transportation, processing and sale of North Slope gas based on preliminary engineering costs, project design characteristics, marketing information and financial assumptions.

Because the project is expected to be heavily capital intensive, System economics will depend in large part on the costs of the System and the relationship of such costs to the value of North Slope gas sold in the marketplace. Based on the studies of its marketing advisors, the Committee has examined Far East markets, principally Japan, in relation to sales of System liquified natural gas (LNG). For the purposes of the analyses therefore, projected market prices for System LNG have been assumed to parallel projected LNG market prices in Japan.

To identify prospective System costs the economic analyses rely on construction and operating cost projections (in 1982 dollars) of Brown & Root, the Committee's engineering consultant, and on certain economic and financial assumptions developed in conjunction with other Committee advisors. The economic analyses have developed base analyses which estimate prospective capital costs of the project at completion (including inflation, interest and financing costs during the construction period), prospective operating tariffs to cover System costs of delivering and processing gas in South Alaska, and prospective economic values for System LNG measured by the difference between the cost of System LNG delivered in Japan and the prospective market value of the gas in Japan. Prospective System tariffs for System gas products are adjusted to reflect the cost of fuel used in the System's transportation and processing facilities.

Prospective System capital costs and tariffs are based on economic and financial assumptions which reflect the preliminary and limited information on the System presently available. The analyses reflect the large capital investment required for construction, the completion and marketing risks connected with an Alaska gas project, and the special characteristics associated with the System including phased construction, transportation and processing of all gas products, construction of the conditioning facilities in South Alaska, System tariffs related to market forces rather than regulatory principles and potential export markets for System LNG.

Key assumptions made in the base analyses include the Brown & Root construction, organization and operating and maintenance costs, private investor project financing, unregulated System tariffs, Japanese market prices for System LNG, as well as financial assumptions as to capital structure, debt, interest rates, equity returns, inflation, LNG price increases and tax consequences.

The base analyses determine a range of prospective tariffs to reflect current uncertainty as to project risk allocation and required equity rate of return expectations. The lower tariff range reflects a lower rate of return on equity investment (30% after tax) on an assumption of limited equity risk, while the higher tariff range assumes increased equity risks and higher return requirements (40% after tax). All System tariffs have been calculated on a breakeven basis to recover all operating costs, fuel costs, debt service, taxes and return on and return of equity investment.

Although the economic analyses examine and use a number of economic and financial assumptions in order to estimate prospective capital costs and tariffs, the current level of uncertainty as to prospective System sponsors, project risk allocation, purchaser interest in System gas products and final System costs inhibit conclusions as to project financeability at the present stage of review. Since financeability will depend in the final analysis on the agreement between the sellers and the buyers of System gas, the present economic analyses do not purport to present a financial plan or conclusions as to financial viability but present prospective System economic consequences based on assumptions deemed reasonable under current conditions.

In addition, although the economic analyses have relied on cost data provided by Brown & Root, such estimates are subject to revision and reestimation as project design is refined and optimized. Furthermore, the marketing and financial assumptions used in the base analyses are preliminary and also subject to change or modification as System analysis develops and as economic and financial conditions change. For these reasons, the tariff results presented in the following tables should be considered as indicative of order of magnitude and should not be viewed as definitive. In order to gain perspective on System economics and feasibility in a volatile economic environment, the analyses calculate a number of sensitivity cases including cost overruns which illustrate the change in tariffs that would occur as a result of variations in the assumptions used in the base analyses.

The base analyses examine the System on two alternative bases. In its most economic configuration the System would be built in three phases and at full completion would be capable of transporting and processing 2.83 billion cubic feet per day (bcf/d) of raw gas from Prudhoe Bay to a South Alaska port (the Total System). Brown & Root estimate that construction and organization costs of the Total System, including pipeline, conditioning and liquefaction facilities, over a period of nine years would approximate $14.3 billion in unescalated 1982 dollars including a 20% allowance for contingencies.

Because each of the phases of the System would be capable of operating as a discrete entity, a second economic analysis focuses on limited operations from the first construction phase capable of transporting and processing approximately 0.95 bcf/d of raw gas (the Phase I System). Construction and organization costs of the Phase I System over a period of five years are estimated by Brown & Root at approximately $7.2 billion in unescalated 1982 dollars. Potential advantages of building and financing a smaller System as an initial step support a separate examination of the Phase I System.

Prospective System Capital Costs and Tariffs Delivered In South Alaska

The tables below summarize the results of the base analyses in terms of prospective System capital costs at completion and tariffs per unit of gas products delivered in South Alaska. All tariffs are expressed in nominal dollars per million British Thermal Units (MMBtu) in the year that initial operations are expected to commence (1988) and are the same for all gas products transported and processed by the System.

Prospective System Capital Costs

(Millions of As Spent Dollars to Completion)

Total System	$ 25,465 (1992)
Phase I System	$ 11,556 (1988)

Prospective System Tariffs Delivered In South Alaska

(1988 Dollars per MMBtu)

	Lower Tariff Range	Higher Tariff Range
Total System	$ 4.67	$ 6.16
Phase I System	$ 5.94	$ 7.91

Prospective Costs of System LNG Delivered in Japan Compared to Projected Japanese LNG Prices

Based on the projections of the marketing advisors the analyses assume an average shipping cost, including the costs of LNG lost through evaporation in transit (boil-off), of approximately $1.00 per MMBtu in 1988 dollars. The table below summarizes the comparison of prospective costs (tariffs and shipping costs) of System LNG delivered in Japan with projected Japanese LNG market prices (based on projections of Mitsubishi Research Institute) in 1988 dollars and indicates the price differential or prospective economic value of System LNG in Japan.

Prospective System LNG Costs

Delivered In Japan Compared to Projected Japanese LNG Prices
(1988 Dollars per MMBtu)

	System LNG Costs Japan (Lower Tariff)	System LNG Costs Japan (Higher Tariff)	Japanese LNG Prices	Economic Value of System LNG (Lower Tariff)	Economic Value of System LNG (Higher Tariff)
Total System	$5.67	$ 7.16	$ 7.89	$ 2.22	$ 0.73
Phase I System	$6.94	$ 8.91	$ 7.89	$ 0.95	$(1.02)

Prospective System tariffs for NGL products delivered in South Alaska have not been analyzed in connection with Japanese markets but have been converted to the following per-barrel tariff costs for the major NGL products, propane and butane, to provide the North Slope producers a basis of comparison with alternative options of conditioning and transporting NGL products:

Prospective NGL Costs Per Barrel Delivered In South Alaska

(1988 Nominal Dollars)

	Total System	
	Lower Tariff	Higher Tariff
Propane	$ 17.79	$ 23.47
Butane	20.50	27.04
	Phase I System	
	Lower Tariff	Higher Tariff
Propane	$ 22.63	$ 30.14
Butane	26.08	34.72

Conclusions

Total System

The tables set forth on page 6 indicate that under the assumptions used in the base analyses, including projected market prices of LNG in Japan, Total System LNG could be expected to compete in the Japanese market and be capable of covering System costs and shipping costs. Additionally, the tables also indicate a range of prospective economic values for Total System LNG, adjusted for fuel costs, of between $2.22 and $0.73 per MMBtu in 1988 dollars.The projected economic values reflect the excess of market prices over the costs of System transportation and processing. The relatively significant economic value in the lower tariff range, $2.22, supports an inference as to economic feasibility. On the other hand, the higher tariff range reflects a case which, if the higher equity return is required by investors, results in relatively little economic value, $0.73, to the gas. This economic value could be further eroded if construction costs were to escalate. In the case of a 30% cost overrun in the higher tariff case, the economic value of the gas would decline to a negative ($0.86) per MMBtu which indicates that although the System could service its debt it would not be able to achieve the higher equity return in the market place.

However, several sensitivity cases examined in the analyses could, if implemented, significantly improve the economics of the Total System even in the higher tariff case. Sensitivity assumptions which could reduce System tariffs and increase economic values include stretching out System debt repayment over the life of the System on a level sinking fund basis, potential State of Alaska tax exempt financing of the liquefaction facilities and expensing interest costs for tax purposes rather than capitalizing them during the construction period. If it were possible to implement these sensitivity cases, the economic value of the gas could be increased from $0.73 in the higher tariff case to approximately $2.16 per MMBtu. More precise analysis of the Total System's economic feasibility, at least in the higher tariff range, must, necessarily, depend on more detailed study of these alternative approaches.

Phase I System

The projected economic value of gas in the Phase I System range from $0.95 in the lower tariff case to a negative ($1.02) per MMBtu in the higher tariff case. The positive value in the lower tariff range supports an assumption as to competitiveness of the gas in the marketplace as well as providing some economic value. However, if the higher equity returns are required the gas would not appear to be competitive. Although the Phase I System might be economically improved to the extent that level debt service or other sensitivity analyses discussed above were available, the effect would probably not be sufficient to make the Phase I System, standing as a discrete economic project, more than marginally economic. The Phase I System might, however, be an acceptable first step construction and financing approach if prospective sponsors determine that the Total System at completion has the potential for attractive economics or that other potential project benefits might accrue to participants.

Economic Analyses Discussion

TAGS Proposal

The Brown & Root proposal for TAGS is an all-Alaska natural gas transportation and processing system. The System contemplates the pipeline transportation of untreated North Slope gas to South Alaska where conditioning and liquefaction facilities would be constructed to treat the gas. The System is expected to consist of the following three principal components:

1) 36 inch diameter pipeline with compression stations, extending from the North Slope gas fields to a tidewater port in South Alaska (the pipeline);

2) conditioning facilities at the terminus of the pipeline to remove carbon dioxide (CO_2) and to extract and fractionate the NGL contained in the gas (the conditioning facilities); and

3) liquefaction facilities also at the South Alaska port to liquefy the LNG for export (the liquefaction facilities).

The Committee has not requested Brown & Root to review additional facilities that will be required outside Alaska.

Phased Construction

Brown & Root has analyzed a three phase schedule for the construction of the System. In the initial phase, construction would extend over a five year period, including a two year study and permitting period, and the

System would be capable of transporting and processing approximately .95 bcf of gas products per day. A second and third phase would expand System capacity by the installation of increased compressor capacity. Construction of the second phase would require an additional two years and would be capable of handling approximately 1.75 bcf/d at completion. The third phase would require a further two years of construction with capacity of approximately 2.83 bcf/d. The total design and construction period through all three phases, therefore, would be nine years. This construction period could be accelerated if phasing were eliminated.

System Component Costs

Brown & Root has estimated on a preliminary basis the construction and organization costs including contingencies, and the operating and maintenance expenses, of the System on an unescalated basis in 1982 dollars. The estimated costs include North Slope refrigeration, pipeline transportation, CO_2 removal, extraction and fractionation of NGL products and the liquefaction of the gas into LNG.

Estimates of construction, organization and operating and maintenance costs are aggregated under the three principal components of the System - the pipeline, the conditioning facilities and the liquefaction facilities (the System components). The construction and organization cost estimates for the System components in 1982 unescalated dollars, including a 20% contingency amount, are summarized for each of the construction phases on a cumulative basis as follows:

	Estimated Cumulative Construction and Organization Costs In 1982 Dollars (Millions)		
	Phase I	Phase II	Phase III
Pipeline	$4,608	$ 6,276	$ 8,243
Conditioning Facilities	702	982	1,423
Liquefaction Facilities	1,863	2,995	4,628
Totals	$7,173	$10,253	$ 14,294

The projected costs do not include estimates of inflation or financing costs during the construction period, the cost of shipping or facilities outside Alaska. The Brown & Root proposal is at a preliminary stage and changes and modifications can be expected in their estimates if they continue to refine, verify and modify their initial projections.

Brown & Root has also provided the following estimates of operating and maintenance expenses (before System fuel costs which are included in the tariff as a cost adjustment) on a cumulative basis in unescalated 1982 dollars:

	Estimated Cumulative Operating and Maintenance Expenses In 1982 Dollars (Millions)		
	Phase I	Phase II	Phase III
Pipeline	$ 20	$ 35	$ 49
Conditioning Facilities	19	27	39
Liquefaction Facilities	39	66	105
Total	$ 78	$ 128	$ 193

Estimated construction, organization and operating and maintenance costs and the projected spending schedule are set forth in Exhibit A.

System Characteristics Affecting Economic Analyses

The proposed TAGS project contains a number of characteristics which affect economic evaluation and analysis. Certain of the major characteristics are general to all North Slope gas projects while others are special to the System and evolve from the design of the TAGS proposal. Among these System characteristics are the following:

General System Characteristics

The System, similar to any other North Slope gas project, will face significant hurdles in order to satisfy existing and prospective laws, regulations, expectations and requirements of the large number of parties, institutions, agencies and governments which must necessarily be involved. Apart from such fundamental problems as environmental factors and political issues involving the production, transportation, processing and sale of North Slope gas, at least three inherent project characteristics can be expected to affect and determine System economics:

Project Size. The proposed System represents an enormous undertaking within the private sphere in terms of physical and financial scope. The total amount of capital, both debt and equity, which will be required to complete the project, and the extended time period over which construction costs will be expended, will undoubtedly place substantial strains on any group of investors. Capital availability in the magnitude contemplated could, under circumstances similar to those which capital markets have experienced in recent years, be problematical. In any event, the costs of such capital can be expected to be substantial to reflect the risks to investors inherent in a project of the size and scope of an Alaskan gas project.

Completion. Due to the large anticipated construction costs, investors will be concerned, as they have in all predecessor projects, about project completion. Other large construction projects have underscored investor concerns with respect to completion. Debt and equity capital will only be available if investors develop confidence that construction costs do not present significant risks of extensive cost overruns or that cost overruns can be provided by responsible credit sources and that the System will be able to function within design parameters. Completion, therefore, constitutes a significant project risk in connection with System economics.

Marketing. Marketing considerations from an economic perspective include both the capacity of the market place to absorb new supply and the price of the gas products at which such demand will materialize. Prior to investment, investors must have reasonable assurances that market demand will exist for the large volumes of gas associated with the System. In addition, gas tariffs cannot be so high that they result in project gas prices which are uncompetitive. As a result of the large anticipated construction costs, a North Slope gas transportation and processing project will be capital intensive and project costs will absorb a significant portion of the value of the gas in the marketplace. Investors must have assurances that the gas products will be competitive and that revenues will be generated to meet project costs and repay capital investment. Marketing risks have been heightened recently due to general world recession, energy conservation efforts, general price weakness in hydrocarbon products, large world gas supplies and gradual natural gas price decontrol in the U.S.

Special System Characteristics

In addition to these general characteristics which have economic and financial implications common to all Alaska gas projects, the System also has a number of special characteristics arising from the System's proposed design which affect System economics. These special characteristics include the following:

Phased Construction. Construction of the System under a three phase approach contemplates completion in stages with the following potential advantages:

1) the ability to transport and process gas at an earlier date;

2) the generation of revenues and tax savings from limited operations in the first and second phases which could provide substantial funds to the System prior to final completion;

3) the build up in System gas volumes on an incremental basis to better match prospective market growth and demand in export markets; and

4) the option to demonstrate the viability and economics of a smaller first phase project prior to commitment to a full scale System.

Transportation of Raw Gas Products. The TAGS proposal contemplates transportation of raw untreated natural gas as it is produced rather than building conditioning facilities on the North Slope and treating the gas before injection into the pipeline. The System, therefore, proposes to ship the raw gas containing a mixture of CO_2, heavy natural gas liquids and methane and ethane gases. As in a gas gathering pipeline, the System proposes to extend the North Slope wellhead to tidewater in South Alaska where the untreated gas will be available for conditioning and processing.

Transporting gas containing substantial quantities of CO_2 (approximately 12 1/2%) will penalize the pipeline by using pipeline capacity for a product which has little or no Btu content and whose value is presently undeterminable (it may be possible, however, for the low Btu CO_2 to be used as fuel for power generation in South Alaska or for injection into Cook Inlet producing fields to enhance hydrocarbon recovery). On the other hand, the volume capacity lost by transporting CO_2 is more than made up by the high compression transportation of NGL products which have Btu content per cubic foot substantially in excess of the methane and ethane gases as well as enabling conditioning in South Alaska. On a blended basis, covering all gas products transported, the total Btu content of the System is increased by approximately 5% as compared to a pipeline which would solely transport methane and ethane products.

Elimination of Alternative NGL Transportation. System design which transports all gas products in one pipeline avoids multiple pipelines or alternative transporation and processing systems. By transporting the NGL products through the System's pipeline it is possible to avoid the financing and construction of a separate liquids pipeline or an alternative transportation and processing system for NGL removed and conditioned on the North Slope.

Conditioning Facilities in South Alaska. Pipeline transportation of all gas products allows conditioning of the products on the South Coast of Alaska. Construction of the conditioning facilities including the gas treating plant to remove the CO_2, and the extraction, fractionation and loading and storage facilities for the NGL, on the South Coast is expected to result in substantial construction and operating and maintenance cost savings as compared to North Slope construction and operation.

Shared Cost Savings. The potential cost savings resulting from the integrated nature of the System's design enabling common transportation and South Alaska conditioning and liquefaction is shared by all System gas products and not just the methane and ethane products.

Potential Markets. System LNG and NGL products would be available in South Alaska for shipment to markets. Shipping costs, however, will significantly affect the costs of System products, and from an economic perspective the natural markets, at least for LNG products, could be expected to be the Far East, principally Japan, and the West Coast of the United States. Demand for LNG in Japan has provided higher price levels for natural gas than in the U.S. In addition, Japanese political and economic policies have promoted the importation of LNG products in substitution for crude oil imports. As a consequence, System LNG output could be expected in the first instance to be directed towards the Japanese market as well as the markets of other industrialized Pacific rim nations. These markets will also be subject to competition from other Pacific area gas producers. Exports of Alaskan natural gas to Japanese or other foreign markets will require the political support and approval of the U.S. government.

Regulation. The legal advisor to the Committee, Birch, Horton, Bittner, Monroe, Pestinger and Anderson, believe that a project which transports and processes gas solely in Alaska and exports gas products to foreign markets may be exempted from the purview of the Natural Gas Act insofar as pipeline tariffs are concerned. It is believed, therefore, that exportation of gas may result in a minimum of federal regulation.

The absence of Federal Energy Regulatory Commission (FERC) ratemaking authority in connection with the System would mean that the System would not have the benefit of the regulatory procedures and authority for passing on mandated price levels in the form of tariffs for its gas products to consumers. Conversely, absent such regulations, the System would not be constrained by regulated maximum tariffs and could negotiate tariffs which reflect the System's economic value in the market place rather than its historic costs. Under any circumstances, however, the jurisdictional nature of the System will have a major impact on System economics and must be determined at an early stage.

While the legal advisor believes that, absent FERC regulation, the System may need a certificate of public convenience and necessity from the

Alaska Public Utilities Commission for construction of the pipeline component, State rate making authority over gas exports will probably not be required.

Ownership of Gas Products. The transportation of raw gas from the North Slope and processing in South Alaska into component products could allow the producers to own System gas throughout all stages of the System to tidewater or beyond.

System Components. The divisable and discrete nature of each of the System's three components-pipeline, conditioning facilities and liquefaction facilities-could provide operating and financial options to the System. Components could be separate entities owned and operated by the same or different sponsoring investors. Independent component entities could delineate jurisdictional issues should they arise. Additionally, separate component financing could provide a degree of flexibility which might enhance System financing subject to the limitation that all components must be financed on a basis to insure timely System completion. Component financing might better reflect the allocation of ownership and financing obligations between parties with different System interests. Divisible components could reduce the magnitude of the financing each participating group would be responsible for, expand the total investment capital made available to the System and potentially reduce the costs of such capital. Examples of component financing include Japanese purchaser financing and/or State of Alaska financing in connection with System component facilities.

Possible State of Alaska Participation. It may be possible for the State of Alaska to participate in System financing through the issuance of tax exempt revenue bonds in connection with the liquefaction facilities. Under Section 103 (b) of the Internal Revenue Code a State port authority is authorized to finance certain dock, wharf and storage facilities by the issuance of tax exempt revenue bonds. State financing of the liquefaction facilities might be analogous to the tax exempt financing of port facilities by the City of Valdez in connection with the oil pipeline. State financing of the liquefaction facilities could contribute to System economics by providing new sources of capital, reducing equity investment in the liquefaction facilities and reducing the cost of debt financing.

It is uncertain, however, whether existing federal tax law permits such financing and the ability to implement tax exempt financing in connection with the liquefaction facilities may depend upon future interpretations or modifications of the tax laws. A revenue ruling from the Internal Revenue Service would undoubtedly be requested. It is also currently unknown whether the State of Alaska would be willing or would have the authority to issue such debt under existing statutory authorization.

Additional Study Necessary for Financing Plan

The general and special characteristics of the System discussed above have a significant bearing on System economics and have, to a large extent, shaped the economic and financial assumptions used in the economic analyses. Should System analysis proceed, each of the System's characteristics would have to be subjected to an extended and in depth study where they would have to be tested and proven to the satisfaction of all potential participants in the project. Additionally, even though the System's special characteristics might provide specific advantages, the general characteristics of any North Slope gas project - large construction costs, extended construction period, frontier pipeline construction conditions, possible environmental and political intervention, as well as non-completion and marketing risks - may still preclude System financing. The development of a feasible financing plan requires further study of the relatively unique delivery design of the System, of gas markets, of potential System sponsors and the design of a project structure which addresses the amounts and kinds of risks investors are willing to bear commensurate with expected returns.

Objective of System Economic Analyses

Based on the general and special characteristics inherent in the TAGS proposal, economic analyses of the System have been undertaken in order to determine on an initial and preliminary basis the potential economics of transporting and processing North Slope gas through the System. The analyses examine the prospective economics of the System as an independent transportation and processing project and does not attempt to measure other potential benefits which might occur as a result of System operations and ownership.

The objective of the economic analyses is to determine on a preliminary basis the prospective costs of transporting and processing System gas and the prospective economic value of System gas measured by the difference between System costs and the value of the gas in the market place. Prospective System costs are determined by using Brown & Root's preliminary estimates of organization, construction and operating and maintenance costs calculated in unescalated 1982 dollars to determine prospective capital costs and a range of prospective tariffs for the three principal components of the System inclusive of estimated inflation and financing costs.

Prospective capital costs of the System represent total construction and organization costs projected by Brown & Root adjusted for assumed inflation and financing costs during the construction period. Prospective capital costs represent the amount of invested capital that would be required to finance the System.

Prospective System tariffs represent the total estimated costs of transporting and processing System gas products delivered in South Alaska on a unit of gas basis. Tariffs include operating and maintenance expenses estimated by Brown & Root adjusted for inflation, System fuel costs, income taxes and the costs of servicing invested capital including the payment of interest and principal on debt and the payment of return on and the return of equity investment.

Prospective System tariffs in South Alaska can be used as a basis for evaluating System costs at the port of embarkation or, alternatively, can be evaluated in relation to specific markets of sale. In the case of System LNG, a comparison of prospective System LNG tariffs and shipping costs to Japan with forecasts of LNG prices in the Japanese market has been made in order to determine potential competitiveness of System LNG and its prospective economic value in the Japanese market. NGL tariffs, on the other hand, have been converted to costs per barrel delivered in South Alaska.

Assumptions for Base Analyses

In determining prospective capital costs and tariffs the economic analyses rely on a number of assumptions which reflect the nature of the System and its currently perceived risks. These assumptions are based in part on an evaluation of the System's general and special characteristics previously discussed. The assumptions used to determine the base analyses are reviewed herein and form the basis upon which System prospective capital costs and tariffs are determined. While the assumptions used in the base analyses are helpful in testing and measuring System economics they should not be viewed as definitive. Any economic analysis of a prospective project has certain inherent limitations which include possible changes in project costs, marketing, tax and financing conditions which could affect, both positively and negatively, the assumptions used to determine project costs and tariffs. The base analyses present estimates of what could happen assuming certain costs and economic circumstances. They do not represent a forecast of what will occur. Indeed, a variety of alternative assumptions were applied in the sensitivity analyses and their effects on System economics are discussed herein. Nevertheless, the base analyses reflect reasonable capital cost and tariff estimates given the preliminary stage of System design and review.

Included among the assumptions used in the base analyses are the following:

Brown & Root Cost Estimates

The Brown & Root estimates of construction and organization costs and operating and maintenance expenses in unescalated 1982 dollars set forth in Exhibit A have been used in the base analyses. The cost estimates do not provide for inflation or financing costs during construction. Because the construction period extends over a number of years and inflation and financial costs can be expected to substantially increase the estimates, the base analyses develop the prospective inflation and financing costs of the System.

Any substantial change or modification in the Brown & Root cost estimates would, of course, significantly affect projected System capital costs and tariffs. Because of 1) the preliminary nature of the Brown & Root cost figures, 2) the limited time period in which they were prepared, and 3) the possibility of slippage in the proposed study and construction period time schedule, the financial evaluation further considers a sensitivity case which assumes a 30% construction cost overrun. Because of the 20% contingency amount already included in the Brown & Root estimates, the total overrun amount in the sensitivity analyses would approximate 56% of original cost estimates.

Total System and Phase I System

Brown & Root has proposed one System constructed in three separate phases over a period of nine years. The economic analyses however, examine two cases. The first analysis, the Total System case, assumes the full capacity three phase project constructed over a nine year construction period and a twenty year operating period as estimated by Brown & Root. The Total System case assumes that partial operations will commence in the 6th year when the first phase is completed and gas deliveries begin, and is stepped up in the 8th year when the second phase is completed, with full capacity in the tenth year.

A second case is also analyzed which assumes that only the first phase is financed and built and the capacity is limited to .95 bcf/d of gas, the Phase I System. The Phase I System assumes a 5 year construction period followed by a 20 year operating period. A Phase I System is examined because of the advantages of arranging financing for a substantially smaller system which would, nevertheless, be capable of transporting and processing substantial amounts of North Slope gas. Although capital costs and operating and maintenance expenses can be expected to be significantly lower in the Phase I System, tariff costs on a unit of gas basis can be expected to be higher because of the greater proportion of fixed costs borne by fewer units transported. The economic analyses develop prospective capital costs and tariffs under both systems to test their economics in the market place. Each case, therefore, is examined for the purposes of the economic analyses as an independent system.

System Components

The economic analyses for both the Total System and the Phase I System determine prospective capital costs and tariffs for each of the System components:

1) pipeline
2) conditioning facilities
3) liquefaction facilities

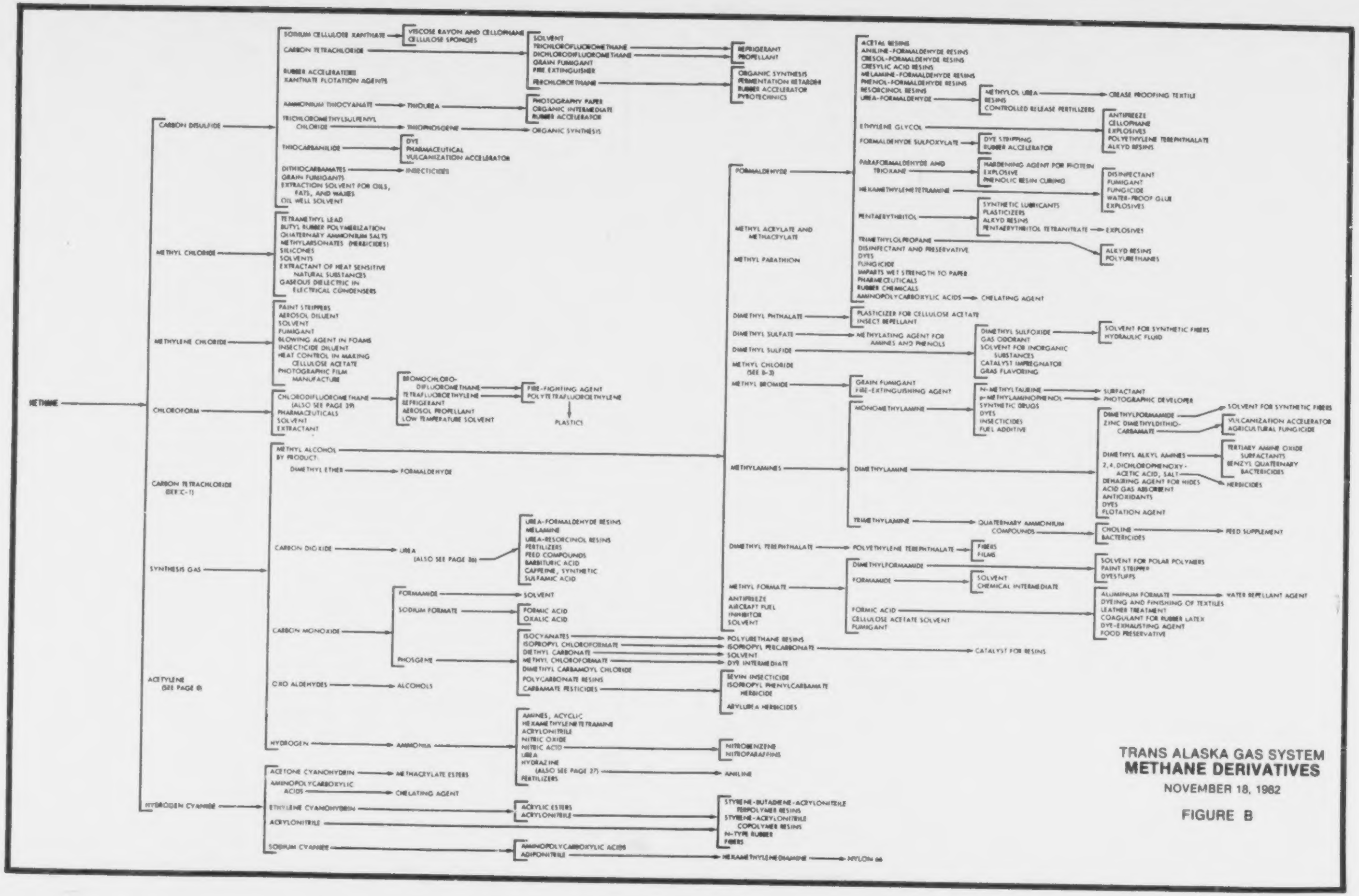
The aggregate of all component costs and tariffs represents total System costs and tariffs.

Gas Product Costs on a Btu Basis

System engineering proposes an aggregate of component facilities which will transport untreated North Slope gas products and process them in South Alaska into marketable products ready for sale and shipment. Although analyzed in terms of separate components the System is one integrated project which relies on the performance of all System components to complete the chain of transporting and processing the gas products into saleable commodities. For purposes of the analyses, therefore, the System has been regarded as one integrated project in which potential cost penalties and cost savings generated by System design are shared equally by all gas products on a Btu basis.

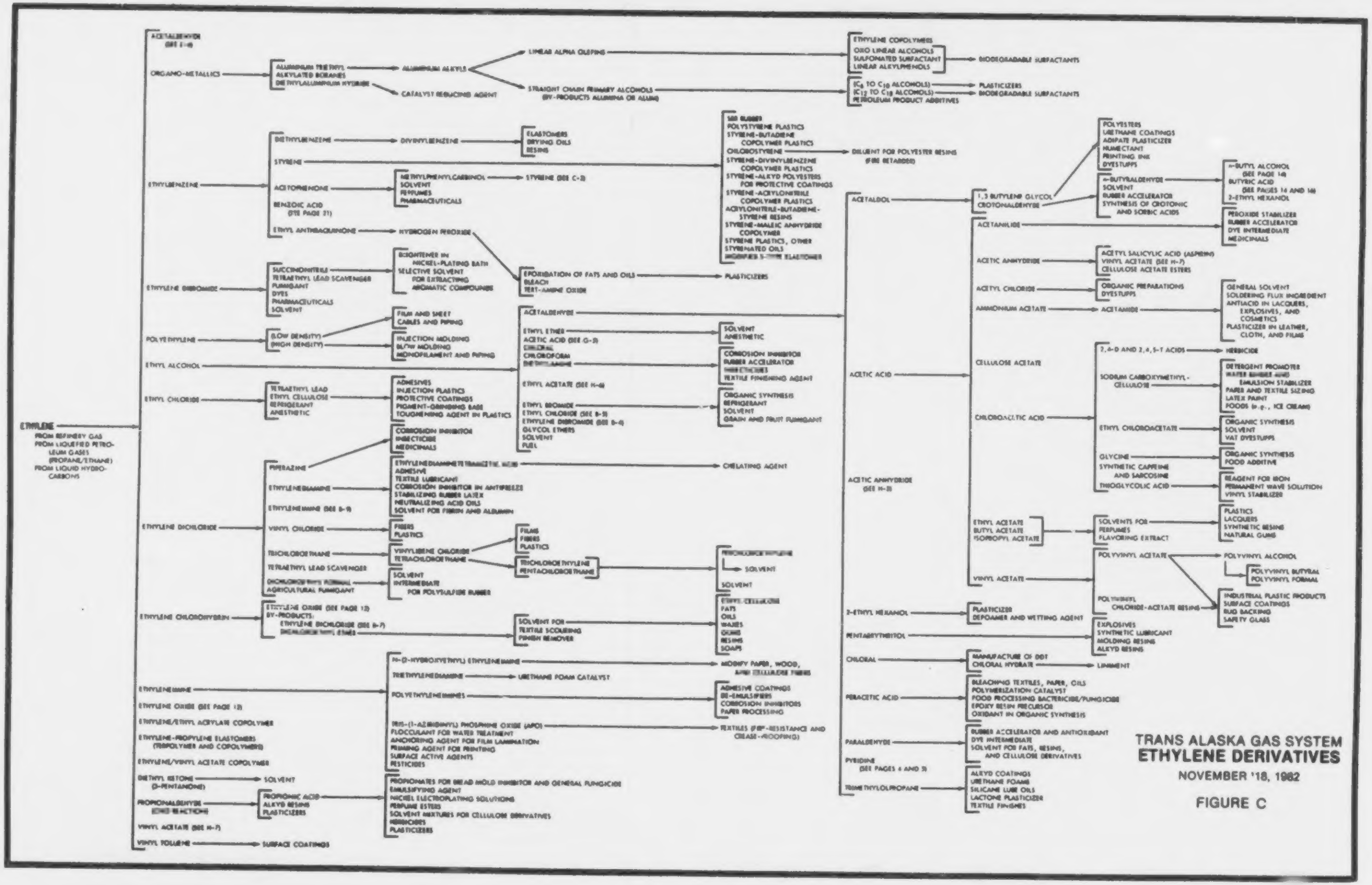
Japanese Markets, Shipping Costs and LNG Prices

The Committee has received and reviewed marketing studies from a number of Japanese advisors. Discussion and conclusions based on these marketing studies have been included in the marketing section of this report. The marketing advisors have advised that Japanese demand for LNG will grow from the 1982 level of approximately 17 million tons per year to approximately 28 million tons in 1985 and between 37 and 42 million tons in 1990 (MITI, a Japanese governmental agency, estimates Japanese demand in 1990 at 43 million tons). To fill the gap between these projected demand levels in 1990 and current supplies, Japanese users have completed or are in discussions on new contracts with LNG suppliers in Australia, Indonesia, Thailand, Malaysia, Qatar, Canada and the U.S.S.R.


METHANE
CARBON DISULFIDE
SODIUM CELLULOSE XANTHATE
VISCOSE RAYON AND CELLOPHANE
CELLULOSE SPONGES
CARBON TETRACHLORIDE
SOLVENT
TRICHLOROFLUOROMETHANE
DICHLORODIFLUOROMETHANE
GRAIN FUMIGANT
FIRE EXTINGUISHER
PERCHLOROETHANE
REFRIGERANT
PROPELLANT
ORGANIC SYNTHESIS
FERMENTATION RETARDER
RUBBER ACCELERATOR
PYROTECHNICS
RUBBER ACCELERATORS
XANTHATE FLOTATION AGENTS
AMMONIUM THIOCYANATE
THIOUREA
PHOTOGRAPHY PAPER
ORGANIC INTERMEDIATE
RUBBER ACCELERATOR
TRICHLOROMETHYLSULFENYL CHLORIDE
THIOPHOSGENE
ORGANIC SYNTHESIS
THIOCARBANILIDE
DYE
PHARMACEUTICAL
VULCANIZATION ACCELERATOR
DITHIOCARBAMATES
INSECTICIDES
GRAIN FUMIGANTS
EXTRACTION SOLVENT FOR OILS, FATS, AND WAXES
OIL WELL SOLVENT
METHYL CHLORIDE
TETRAMETHYL LEAD
BUTYL RUBBER POLYMERIZATION
QUATERNARY AMMONIUM SALTS
METHYLARSONATES (HERBICIDES)
SILICONES
SOLVENTS
EXTRACTANT OF HEAT SENSITIVE NATURAL SUBSTANCES
GASEOUS DIELECTRIC IN ELECTRICAL CONDENSERS
METHYLENE CHLORIDE
PAINT STRIPPERS
AEROSOL DILUENT
SOLVENT
FUMIGANT
BLOWING AGENT IN FOAMS
INSECTICIDE DILUENT
HEAT CONTROL IN MAKING CELLULOSE ACETATE
PHOTOGRAPHIC FILM MANUFACTURE
CHLOROFORM
CHLORODIFLUOROMETHANE (ALSO SEE PAGE 39)
PHARMACEUTICALS
SOLVENT
EXTRACTANT
BROMOCHLORO-DIFLUOROMETHANE
TETRAFLUOROETHYLENE
REFRIGERANT
AEROSOL PROPELLANT
LOW TEMPERATURE SOLVENT
FIRE-FIGHTING AGENT
POLYTETRAFLUOROETHYLENE
PLASTICS
CARBON TETRACHLORIDE (SEE C-1)
SYNTHESIS GAS
METHYL ALCOHOL
BY PRODUCT:
DIMETHYL ETHER
FORMALDEHYDE
CARBON DIOXIDE
UREA (ALSO SEE PAGE 26)
UREA-FORMALDEHYDE RESINS
MELAMINE
UREA-RESORCINOL RESINS
FERTILIZERS
FEED COMPOUNDS
BARBITURIC ACID
CAFFEINE, SYNTHETIC
SULFAMIC ACID
CARBON MONOXIDE
FORMAMIDE
SOLVENT
SODIUM FORMATE
FORMIC ACID
OXALIC ACID
PHOSGENE
ISOCYANATES
ISOPROPYL CHLOROFORMATE
DIETHYL CARBONATE
METHYL CHLOROFORMATE
DIMETHYL CARBAMOYL CHLORIDE
POLYCARBONATE RESINS
CARBAMATE PESTICIDES
POLYURETHANE RESINS
ISOPROPYL PERCARBONATE
SOLVENT
DYE INTERMEDIATE
CATALYST FOR RESINS
SEVIN INSECTICIDE
ISOPROPYL PHENYLCARBAMATE HERBICIDE
ARYLUREA HERBICIDES
ACETYLENE (SEE PAGE 8)
OXO ALDEHYDES
ALCOHOLS
HYDROGEN
AMMONIA
AMINES, ACYCLIC
HEXAMETHYLENETETRAMINE
ACRYLONITRILE
NITRIC OXIDE
NITRIC ACID
UREA
HYDRAZINE (ALSO SEE PAGE 27)
FERTILIZERS
NITROBENZENE
NITROPARAFFINS
ANILINE
HYDROGEN CYANIDE
ACETONE CYANOHYDRIN
METHACRYLATE ESTERS
AMINOPOLYCARBOXYLIC ACIDS
CHELATING AGENT
ETHYLENE CYANOHYDRIN
ACRYLIC ESTERS
ACRYLONITRILE
ACRYLONITRILE
STYRENE-BUTADIENE-ACRYLONITRILE TERPOLYMER RESINS
STYRENE-ACRYLONITRILE COPOLYMER RESINS
N-TYPE RUBBER
FIBERS
SODIUM CYANIDE
AMINOPOLYCARBOXYLIC ACIDS
ADIPONITRILE
HEXAMETHYLENEDIAMINE
NYLON 66
FORMALDEHYDE
ACETAL RESINS
ANILINE-FORMALDEHYDE RESINS
CRESOL-FORMALDEHYDE RESINS
CRESYLIC ACID RESINS
MELAMINE-FORMALDEHYDE RESINS
PHENOL-FORMALDEHYDE RESINS
RESORCINOL RESINS
UREA-FORMALDEHYDE
METHYLOL UREA
RESINS
CONTROLLED RELEASE FERTILIZERS
CREASE PROOFING TEXTILE
ETHYLENE GLYCOL
ANTIFREEZE
CELLOPHANE
EXPLOSIVES
POLYETHYLENE TEREPHTHALATE
ALKYD RESINS
FORMALDEHYDE SULFOXYLATE
DYE STRIPPING
RUBBER ACCELERATOR
PARAFORMALDEHYDE AND TRIOXANE
HARDENING AGENT FOR PROTEIN
EXPLOSIVE
PHENOLIC RESIN CURING
HEXAMETHYLENETETRAMINE
DISINFECTANT
FUMIGANT
FUNGICIDE
WATER-PROOF GLUE
EXPLOSIVES
PENTAERYTHRITOL
SYNTHETIC LUBRICANTS
PLASTICIZERS
ALKYD RESINS
PENTAERYTHRITOL TETRANITRATE
EXPLOSIVES
TRIMETHYLOLPROPANE
ALKYD RESINS
POLYURETHANES
DISINFECTANT AND PRESERVATIVE
DYES
FUNGICIDE
IMPARTS WET STRENGTH TO PAPER
PHARMACEUTICALS
RUBBER CHEMICALS
AMINOPOLYCARBOXYLIC ACIDS
CHELATING AGENT
METHYL ACRYLATE AND METHACRYLATE
METHYL PARATHION
DIMETHYL PHTHALATE
PLASTICIZER FOR CELLULOSE ACETATE
INSECT REPELLANT
DIMETHYL SULFATE
METHYLATING AGENT FOR AMINES AND PHENOLS
DIMETHYL SULFIDE
DIMETHYL SULFOXIDE
GAS ODORANT
SOLVENT FOR INORGANIC SUBSTANCES
CATALYST IMPREGNATOR
GRAS FLAVORING
SOLVENT FOR SYNTHETIC FIBERS
HYDRAULIC FLUID
METHYL CHLORIDE (SEE B-3)
METHYL BROMIDE
GRAIN FUMIGANT
FIRE-EXTINGUISHING AGENT
METHYLAMINES
MONOMETHYLAMINE
N-METHYLTAURINE
p-METHYLAMINOPHENOL
SYNTHETIC DRUGS
DYES
INSECTICIDES
FUEL ADDITIVE
SURFACTANT
PHOTOGRAPHIC DEVELOPER
DIMETHYLAMINE
DIMETHYLFORMAMIDE
ZINC DIMETHYLDITHIO-CARBAMATE
SOLVENT FOR SYNTHETIC FIBERS
VULCANIZATION ACCELERATOR
AGRICULTURAL FUNGICIDE
DIMETHYL ALKYL AMINES
TERTIARY AMINE OXIDE SURFACTANTS
BENZYL QUATERNARY BACTERICIDES
2,4-DICHLOROPHENOXY-ACETIC ACID, SALT
HERBICIDES
DEHAIRING AGENT FOR HIDES
ACID GAS ABSORBENT
ANTIOXIDANTS
DYES
FLOTATION AGENT
TRIMETHYLAMINE
QUATERNARY AMMONIUM COMPOUNDS
CHOLINE
BACTERICIDES
FEED SUPPLEMENT
DIMETHYL TEREPHTHALATE
POLYETHYLENE TEREPHTHALATE
FIBERS
FILMS
METHYL FORMATE
DIMETHYLFORMAMIDE
SOLVENT FOR POLAR POLYMERS
PAINT STRIPPER
DYESTUFFS
FORMAMIDE
SOLVENT
CHEMICAL INTERMEDIATE
FORMIC ACID
ALUMINUM FORMATE
WATER REPELLANT AGENT
DYEING AND FINISHING OF TEXTILES
LEATHER TREATMENT
COAGULANT FOR RUBBER LATEX
DYE-EXHAUSTING AGENT
FOOD PRESERVATIVE
CELLULOSE ACETATE SOLVENT
FUMIGANT
ANTIFREEZE
AIRCRAFT FUEL
INHIBITOR
SOLVENT

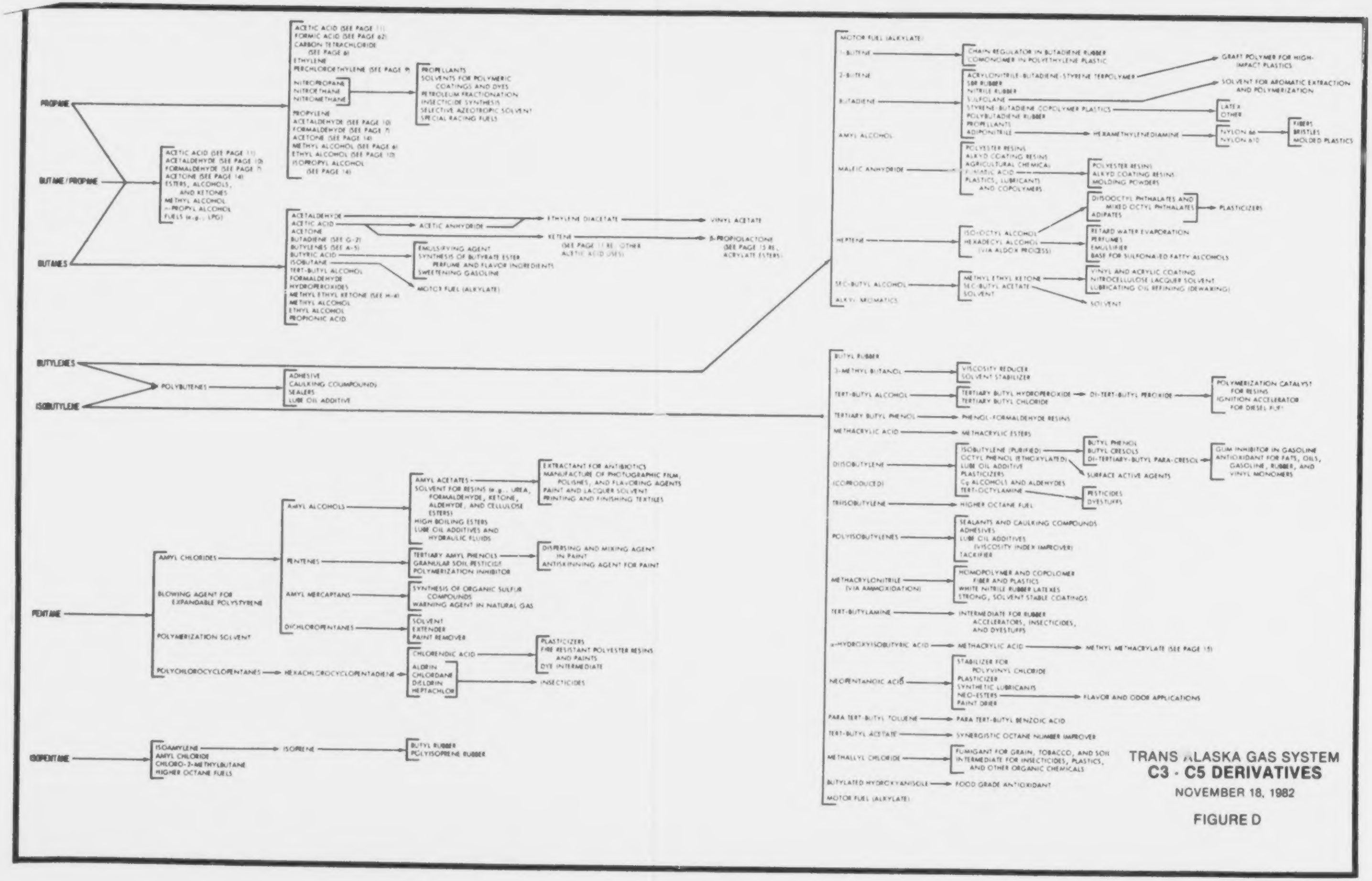
TRANS ALASKA GAS SYSTEM
METHANE DERIVATIVES
NOVEMBER 18, 1982

FIGURE B


ETHYLENE
FROM REFINERY GAS
FROM LIQUEFIED PETROLEUM GASES (PROPANE/ETHANE)
FROM LIQUID HYDROCARBONS
ACETALDEHYDE (SEE [illegible])
ORGANO-METALLICS
ALUMINUM TRIETHYL
ALKYLATED BORANES
DIETHYLALUMINUM HYDRIDE
ALUMINUM ALKYLS
CATALYST REDUCING AGENT
LINEAR ALPHA OLEFINS
STRAIGHT CHAIN PRIMARY ALCOHOLS (BY-PRODUCTS ALUMINA OR ALUM)
ETHYLENE COPOLYMERS
OXO LINEAR ALCOHOLS
SULFONATED SURFACTANT
LINEAR ALKYLPHENOLS
BIODEGRADABLE SURFACTANTS
(C_6 TO C_{10} ALCOHOLS)
(C_{12} TO C_{18} ALCOHOLS)
PETROLEUM PRODUCT ADDITIVES
PLASTICIZERS
BIODEGRADABLE SURFACTANTS
ETHYLBENZENE
DIETHYLBENZENE
DIVINYLBENZENE
ELASTOMERS
DRYING OILS
RESINS
STYRENE
ACETOPHENONE
METHYLPHENYLCARBINOL
SOLVENT
PERFUMES
PHARMACEUTICALS
STYRENE (SEE C-2)
BENZOIC ACID (SEE PAGE 21)
ETHYL ANTHRAQUINONE
HYDROGEN PEROXIDE
SBR RUBBER
POLYSTYRENE PLASTICS
STYRENE-BUTADIENE COPOLYMER PLASTICS
CHLOROSTYRENE
DILUENT FOR POLYESTER RESINS (FIRE RETARDER)
STYRENE-DIVINYLBENZENE COPOLYMER PLASTICS
STYRENE-ALKYD POLYESTERS FOR PROTECTIVE COATINGS
STYRENE-ACRYLONITRILE COPOLYMER PLASTICS
ACRYLONITRILE-BUTADIENE-STYRENE RESINS
STYRENE-MALEIC ANHYDRIDE COPOLYMER
STYRENE PLASTICS, OTHER
STYRENATED OILS
MODIFIED S-TYPE ELASTOMER
ETHYLENE DIBROMIDE
SUCCINONITRILE
TETRAETHYL LEAD SCAVENGER
FUMIGANT
DYES
PHARMACEUTICALS
SOLVENT
BRIGHTENER IN NICKEL-PLATING BATH
SELECTIVE SOLVENT FOR EXTRACTING AROMATIC COMPOUNDS
EPOXIDATION OF FATS AND OILS
BLEACH
TERT-AMINE OXIDE
PLASTICIZERS
POLYETHYLENE
(LOW DENSITY)
(HIGH DENSITY)
FILM AND SHEET
CABLES AND PIPING
INJECTION MOLDING
BLOW MOLDING
MONOFILAMENT AND PIPING
ETHYL ALCOHOL
ACETALDEHYDE
ETHYL ETHER
ACETIC ACID (SEE G-3)
CHLORAL
CHLOROFORM
DIETHYLAMINE
ETHYL ACETATE (SEE H-6)
ETHYL BROMIDE
ETHYL CHLORIDE (SEE B-5)
ETHYLENE DIBROMIDE (SEE B-4)
GLYCOL ETHERS
SOLVENT
FUEL
SOLVENT
ANESTHETIC
CORROSION INHIBITOR
RUBBER ACCELERATOR
INSECTICIDES
TEXTILE FINISHING AGENT
ORGANIC SYNTHESIS
REFRIGERANT
SOLVENT
GRAIN AND FRUIT FUMIGANT
ETHYL CHLORIDE
TETRAETHYL LEAD
ETHYL CELLULOSE
REFRIGERANT
ANESTHETIC
ADHESIVES
INJECTION PLASTICS
PROTECTIVE COATINGS
PIGMENT-GRINDING BASE
TOUGHENING AGENT IN PLASTICS
ETHYLENE DICHLORIDE
PIPERAZINE
CORROSION INHIBITOR
INSECTICIDE
MEDICINALS
ETHYLENEDIAMINE
ETHYLENEDIAMINETETRAACETIC ACID
ADHESIVE
TEXTILE LUBRICANT
CORROSION INHIBITOR IN ANTIFREEZE
STABILIZING RUBBER LATEX
NEUTRALIZING ACID OILS
SOLVENT FOR FIBRIN AND ALBUMIN
CHELATING AGENT
ETHYLENEIMINE (SEE B-9)
VINYL CHLORIDE
FIBERS
PLASTICS
TRICHLOROETHANE
VINYLIDENE CHLORIDE
TETRACHLOROETHANE
FILMS
FIBERS
PLASTICS
TRICHLOROETHYLENE
PENTACHLOROETHANE
PERCHLOROETHYLENE
SOLVENT
SOLVENT
TETRAETHYL LEAD SCAVENGER
DICHLOROETHYL FORMAL
AGRICULTURAL FUMIGANT
SOLVENT
INTERMEDIATE FOR POLYSULFIDE RUBBER
ETHYLENE CHLOROHYDRIN
ETHYLENE OXIDE (SEE PAGE 12)
BY-PRODUCTS:
ETHYLENE DICHLORIDE (SEE B-7)
DICHLOROETHYL ETHER
SOLVENT FOR
TEXTILE SCOURING
FINISH REMOVER
ETHYL CELLULOSE
FATS
OILS
WAXES
GUMS
RESINS
SOAPS
ETHYLENEIMINE
N-(2-HYDROXYETHYL) ETHYLENEIMINE
MODIFY PAPER, WOOD, AND CELLULOSE FIBERS
TRIETHYLENEDIAMINE
URETHANE FOAM CATALYST
POLYETHYLENEIMINES
ADHESIVE COATINGS
DE-EMULSIFIERS
CORROSION INHIBITORS
PAPER PROCESSING
TRIS-(1-AZIRIDINYL) PHOSPHINE OXIDE (APO)
FLOCCULANT FOR WATER TREATMENT
ANCHORING AGENT FOR FILM LAMINATION
PRIMING AGENT FOR PRINTING
SURFACE ACTIVE AGENTS
PESTICIDES
TEXTILES (FIRE-RESISTANCE AND CREASE-PROOFING)
ETHYLENE OXIDE (SEE PAGE 12)
ETHYLENE/ETHYL ACRYLATE COPOLYMER
ETHYLENE-PROPYLENE ELASTOMERS (TERPOLYMER AND COPOLYMERS)
ETHYLENE/VINYL ACETATE COPOLYMER
DIETHYL KETONE (3-PENTANONE)
SOLVENT
PROPIONALDEHYDE (OXO REACTION)
PROPIONIC ACID
ALKYD RESINS
PLASTICIZERS
PROPIONATES FOR BREAD MOLD INHIBITOR AND GENERAL FUNGICIDE
EMULSIFYING AGENT
NICKEL ELECTROPLATING SOLUTIONS
PERFUME ESTERS
SOLVENT MIXTURES FOR CELLULOSE DERIVATIVES
HERBICIDES
PLASTICIZERS
VINYL ACETATE (SEE H-7)
VINYL TOLUENE
SURFACE COATINGS
ACETALDOL
1,3 BUTYLENE GLYCOL
CROTONALDEHYDE
POLYESTERS
URETHANE COATINGS
ADIPATE PLASTICIZER
HUMECTANT
PRINTING INK
DYESTUFFS
n-BUTYRALDEHYDE
SOLVENT
RUBBER ACCELERATOR
SYNTHESIS OF CROTONIC AND SORBIC ACIDS
n-BUTYL ALCOHOL (SEE PAGE 14)
BUTYRIC ACID (SEE PAGES 14 AND 16)
2-ETHYL HEXANOL
ACETANILIDE
PEROXIDE STABILIZER
RUBBER ACCELERATOR
DYE INTERMEDIATE
MEDICINALS
ACETIC ACID
ACETIC ANHYDRIDE
ACETYL SALICYLIC ACID (ASPIRIN)
VINYL ACETATE (SEE H-7)
CELLULOSE ACETATE ESTERS
ACETYL CHLORIDE
ORGANIC PREPARATIONS
DYESTUFFS
AMMONIUM ACETATE
ACETAMIDE
GENERAL SOLVENT
SOLDERING FLUX INGREDIENT
ANTIACID IN LACQUERS, EXPLOSIVES, AND COSMETICS
PLASTICIZER IN LEATHER, CLOTH, AND FILMS
CELLULOSE ACETATE
CHLOROACETIC ACID
2,4-D AND 2,4,5-T ACIDS
HERBICIDE
SODIUM CARBOXYMETHYL-CELLULOSE
DETERGENT PROMOTER
WATER BINDER AND EMULSION STABILIZER
PAPER AND TEXTILE SIZING
LATEX PAINT
FOODS (e.g., ICE CREAM)
ETHYL CHLOROACETATE
ORGANIC SYNTHESIS
SOLVENT
VAT DYESTUFFS
GLYCINE
ORGANIC SYNTHESIS
FOOD ADDITIVE
SYNTHETIC CAFFEINE AND SARCOSINE
THIOGLYCOLIC ACID
REAGENT FOR IRON
PERMANENT WAVE SOLUTION
VINYL STABILIZER
ACETIC ANHYDRIDE (SEE H-3)
ETHYL ACETATE
BUTYL ACETATE
ISOPROPYL ACETATE
SOLVENTS FOR
PERFUMES
FLAVORING EXTRACT
PLASTICS
LACQUERS
SYNTHETIC RESINS
NATURAL GUMS
VINYL ACETATE
POLYVINYL ACETATE
POLYVINYL ALCOHOL
POLYVINYL BUTYRAL
POLYVINYL FORMAL
POLYVINYL CHLORIDE-ACETATE RESINS
INDUSTRIAL PLASTIC PRODUCTS
SURFACE COATINGS
RUG BACKING
SAFETY GLASS
2-ETHYL HEXANOL
PLASTICIZER
DEFOAMER AND WETTING AGENT
PENTAERYTHRITOL
EXPLOSIVES
SYNTHETIC LUBRICANT
MOLDING RESINS
ALKYD RESINS
CHLORAL
MANUFACTURE OF DDT
CHLORAL HYDRATE
LINIMENT
PERACETIC ACID
BLEACHING TEXTILES, PAPER, OILS
POLYMERIZATION CATALYST
FOOD PROCESSING BACTERICIDE/FUNGICIDE
EPOXY RESIN PRECURSOR
OXIDANT IN ORGANIC SYNTHESIS
PARALDEHYDE
RUBBER ACCELERATOR AND ANTIOXIDANT
DYE INTERMEDIATE
SOLVENT FOR FATS, RESINS, AND CELLULOSE DERIVATIVES
PYRIDINE (SEE PAGES 4 AND 5)
TRIMETHYLOLPROPANE
ALKYD COATINGS
URETHANE FOAMS
SILICANE LUBE OILS
LACTONE PLASTICIZER
TEXTILE FINISHES

TRANS ALASKA GAS SYSTEM
ETHYLENE DERIVATIVES
NOVEMBER '18, 1982

FIGURE C


PROPANE
BUTANE / PROPANE
BUTANES
BUTYLENES
ISOBUTYLENE
PENTANE
ISOPENTANE
ACETIC ACID (SEE PAGE 11)
FORMIC ACID (SEE PAGE 62)
CARBON TETRACHLORIDE (SEE PAGE 6)
ETHYLENE
PERCHLOROETHYLENE (SEE PAGE 9)
NITROPROPANE
NITROETHANE
NITROMETHANE
PROPYLENE
ACETALDEHYDE (SEE PAGE 10)
FORMALDEHYDE (SEE PAGE 7)
ACETONE (SEE PAGE 14)
METHYL ALCOHOL (SEE PAGE 6)
ETHYL ALCOHOL (SEE PAGE 10)
ISOPROPYL ALCOHOL (SEE PAGE 14)
PROPELLANTS
SOLVENTS FOR POLYMERIC COATINGS AND DYES
PETROLEUM FRACTIONATION
INSECTICIDE SYNTHESIS
SELECTIVE AZEOTROPIC SOLVENT
SPECIAL RACING FUELS
ACETIC ACID (SEE PAGE 11)
ACETALDEHYDE (SEE PAGE 10)
FORMALDEHYDE (SEE PAGE 7)
ACETONE (SEE PAGE 14)
ESTERS, ALCOHOLS, AND KETONES
METHYL ALCOHOL
n-PROPYL ALCOHOL
FUELS (e.g., LPG)
ACETALDEHYDE
ACETIC ACID
ACETONE
BUTADIENE (SEE G-2)
BUTYLENES (SEE A-5)
BUTYRIC ACID
ISOBUTANE
TERT-BUTYL ALCOHOL
FORMALDEHYDE
HYDROPEROXIDES
METHYL ETHYL KETONE (SEE H-4)
METHYL ALCOHOL
ETHYL ALCOHOL
PROPIONIC ACID
ACETIC ANHYDRIDE
ETHYLENE DIACETATE
VINYL ACETATE
KETENE (SEE PAGE 11 RE. OTHER ACETIC ACID USES)
β-PROPIOLACTONE (SEE PAGE 15 RE. ACRYLATE ESTERS)
EMULSIFYING AGENT
SYNTHESIS OF BUTYRATE ESTER
PERFUME AND FLAVOR INGREDIENTS
SWEETENING GASOLINE
MOTOR FUEL (ALKYLATE)
POLYBUTENES
ADHESIVE
CAULKING COUMPOUNDS
SEALERS
LUBE OIL ADDITIVE
AMYL CHLORIDES
BLOWING AGENT FOR EXPANDABLE POLYSTYRENE
POLYMERIZATION SOLVENT
POLYCHLOROCYCLOPENTANES
HEXACHLOROCYCLOPENTADIENE
AMYL ALCOHOLS
PENTENES
AMYL MERCAPTANS
DICHLOROPENTANES
AMYL ACETATES
SOLVENT FOR RESINS (e.g., UREA, FORMALDEHYDE, KETONE, ALDEHYDE, AND CELLULOSE ESTERS)
HIGH BOILING ESTERS
LUBE OIL ADDITIVES AND HYDRAULIC FLUIDS
EXTRACTANT FOR ANTIBIOTICS
MANUFACTURE OF PHOTOGRAPHIC FILM, POLISHES, AND FLAVORING AGENTS
PAINT AND LACQUER SOLVENT
PRINTING AND FINISHING TEXTILES
TERTIARY AMYL PHENOLS
GRANULAR SOIL PESTICIDE
POLYMERIZATION INHIBITOR
DISPERSING AND MIXING AGENT IN PAINT
ANTISKINNING AGENT FOR PAINT
SYNTHESIS OF ORGANIC SULFUR COMPOUNDS
WARNING AGENT IN NATURAL GAS
SOLVENT
EXTENDER
PAINT REMOVER
CHLORENDIC ACID
ALDRIN
CHLORDANE
DIELDRIN
HEPTACHLOR
PLASTICIZERS
FIRE RESISTANT POLYESTER RESINS AND PAINTS
DYE INTERMEDIATE
INSECTICIDES
ISOAMYLENE
AMYL CHLORIDE
CHLORO-2-METHYLBUTANE
HIGHER OCTANE FUELS
ISOPRENE
BUTYL RUBBER
POLYISOPRENE RUBBER
MOTOR FUEL (ALKYLATE)
1-BUTENE
2-BUTENE
BUTADIENE
AMYL ALCOHOL
MALEIC ANHYDRIDE
HEPTENE
SEC-BUTYL ALCOHOL
ALKYL AROMATICS
CHAIN REGULATOR IN BUTADIENE RUBBER
COMONOMER IN POLYETHYLENE PLASTIC
ACRYLONITRILE-BUTADIENE-STYRENE TERPOLYMER
SBR RUBBER
NITRILE RUBBER
SULFOLANE
STYRENE-BUTADIENE COPOLYMER PLASTICS
POLYBUTADIENE RUBBER
PROPELLANTS
ADIPONITRILE
HEXAMETHYLENEDIAMINE
GRAFT POLYMER FOR HIGH-IMPACT PLASTICS
SOLVENT FOR AROMATIC EXTRACTION AND POLYMERIZATION
LATEX
OTHER
NYLON 66
NYLON 610
FIBERS
BRISTLES
MOLDED PLASTICS
POLYESTER RESINS
ALKYD COATING RESINS
AGRICULTURAL CHEMICAL
FUMARIC ACID
PLASTICS, LUBRICANTS AND COPOLYMERS
POLYESTER RESINS
ALKYD COATING RESINS
MOLDING POWDERS
ISO-OCTYL ALCOHOL
HEXADECYL ALCOHOL (VIA ALDOX PROCESS)
DIISOOCTYL PHTHALATES AND MIXED OCTYL PHTHALATES
ADIPATES
PLASTICIZERS
RETARD WATER EVAPORATION
PERFUMES
EMULSIFIER
BASE FOR SULFONATED FATTY ALCOHOLS
METHYL ETHYL KETONE
SEC-BUTYL ACETATE
SOLVENT
VINYL AND ACRYLIC COATING
NITROCELLULOSE LACQUER SOLVENT
LUBRICATING OIL REFINING (DEWAXING)
SOLVENT
BUTYL RUBBER
3-METHYL BUTANOL
TERT-BUTYL ALCOHOL
TERTIARY BUTYL PHENOL
METHACRYLIC ACID
DIISOBUTYLENE
(COPRODUCED)
TRIISOBUTYLENE
POLYISOBUTYLENES
METHACRYLONITRILE (VIA AMMOXIDATION)
TERT-BUTYLAMINE
α-HYDROXYISOBUTYRIC ACID
NEOPENTANOIC ACID
PARA TERT-BUTYL TOLUENE
TERT-BUTYL ACETATE
METHALLYL CHLORIDE
BUTYLATED HYDROXYANISOLE
MOTOR FUEL (ALKYLATE)
VISCOSITY REDUCER
SOLVENT STABILIZER
TERTIARY BUTYL HYDROPEROXIDE
TERTIARY BUTYL CHLORIDE
DI-TERT-BUTYL PEROXIDE
POLYMERIZATION CATALYST FOR RESINS
IGNITION ACCELERATOR FOR DIESEL FUEL
PHENOL-FORMALDEHYDE RESINS
METHACRYLIC ESTERS
ISOBUTYLENE (PURIFIED)
OCTYL PHENOL (ETHOXYLATED)
LUBE OIL ADDITIVE
PLASTICIZERS
C9 ALCOHOLS AND ALDEHYDES
TERT-OCTYLAMINE
BUTYL PHENOL
BUTYL CRESOLS
DI-TERTIARY-BUTYL PARA-CRESOL
SURFACE ACTIVE AGENTS
PESTICIDES
DYESTUFFS
GUM INHIBITOR IN GASOLINE
ANTIOXIDANT FOR FATS, OILS, GASOLINE, RUBBER, AND VINYL MONOMERS
HIGHER OCTANE FUEL
SEALANTS AND CAULKING COMPOUNDS
ADHESIVES
LUBE OIL ADDITIVES (VISCOSITY INDEX IMPROVER)
TACKIFIER
HOMOPOLYMER AND COPOLOMER FIBER AND PLASTICS
WHITE NITRILE RUBBER LATEXES
STRONG, SOLVENT STABLE COATINGS
INTERMEDIATE FOR RUBBER ACCELERATORS, INSECTICIDES, AND DYESTUFFS
METHACRYLIC ACID
METHYL METHACRYLATE (SEE PAGE 15)
STABILIZER FOR POLYVINYL CHLORIDE
PLASTICIZER
SYNTHETIC LUBRICANTS
NEO-ESTERS
PAINT DRIER
FLAVOR AND ODOR APPLICATIONS
PARA TERT-BUTYL BENZOIC ACID
SYNERGISTIC OCTANE NUMBER IMPROVER
FUMIGANT FOR GRAIN, TOBACCO, AND SOIL
INTERMEDIATE FOR INSECTICIDES, PLASTICS, AND OTHER ORGANIC CHEMICALS
FOOD GRADE ANTIOXIDANT

TRANS ALASKA GAS SYSTEM
C3 - C5 DERIVATIVES
NOVEMBER 18, 1982

FIGURE D

System volume is expected to total approximately 5 million tons in 1988 and to grow to approximately 14 million tons by 1992. Although the Committee believes that the Japanese market will have the potential capacity to absorb a major portion of System LNG, the System must actively compete at an early stage with other sources of supply to ensure timely System LNG sales. The Committee does not assume at the present time, therefore, that the Japanese market will, in fact, absorb System LNG. This conclusion can only be determined after negotiation between owners of the gas and potential gas purchasers and will depend in part on the attitude and support of both the U.S. and Japanese governments. However, because of this potential Japanese market the base analyses have analyzed System LNG, constituting over 80% of the Btu content of System gas products, in relation to the Japanese markets and for analytical comparison the analyses assume the transportation to and sale of LNG products in Japan at projected Japanese LNG prices.

Transportation costs to Japan assume estimated shipping costs as determined by the Committee's shipping advisors. Shipping costs assume the construction and financing of a new LNG tanker fleet in Japan and include the boil off of System LNG in shipment. Although one of the Committee's marketing advisors considers that the boil off LNG could be used as ship fuel this has not been assumed for the purposes of the analyses. Estimated shipping costs in 1988 dollars are assumed to approximate $1.00 per MMBtu.

The Committee's marketing report relies on Mitsubishi Research Institute's (MRI), one of the marketing advisors, estimates of future LNG prices in Japan. The MRI projections assume LNG price parity with imported crude prices in Japan and are projected to increase from the $5.90 level in 1982 to approximately $7.89 per MMBtu in 1988, the first year of System operations. This price growth represents a 5% compound growth rate over the period. MRI projects a compound annual rate of increase of 7% thereafter. Unlike other recent projections of world oil prices which assume real price increases over general inflation rates, MRI forecasts a decline in real prices of LNG between 1982 and 1988, as compared to their own inflation assumptions and the 7% inflation rate assumption used in the analyses. Estimates of LNG prices by other marketing advisors were somewhat higher than the MRI projections and included forecasts of real LNG price increases.

Unregulated Tariff Rates

Based on the advice of the legal advisor it has been assumed for the purposes of the base analyses that because prospective markets for System LNG may be international export markets, primarily Japan, System tariffs will not be regulated by the FERC. In addition, it is also assumed on the advice of the legal advisor that although the Alaska Public Utilities Commission may have jurisdiction to issue a certificate of convenience and public necessity to construct the pipeline, it will not have or exercise jurisdiction over System tariffs. Tariffs, therefore, for purposes of the analyses are not based on rate base principles involving historical costs. It is assumed that tariffs will be negotiated in transportation and processing agreements between the System and the owners of the gas products and will reflect both prospective System costs and the potential market value of the gas products.

Private Investor Project Financing

The base analyses assume that the System will be financed by private investors in a project financing. Private investor project financing contemplates the creation of a new entity to finance, contruct, own and operate the System's component facilities. To effect a project financing, it is generally necessary for the new entity to secure contractual commitments for funds at least equal to the estimated cost of the project prior to the commencement of construction. Estimated costs must provide for adequate construction cost contingencies and for inflation and financing costs during the construction period. Commitments are secured from project sponsors in the form of equity capital and from lenders in the form of debt capital.

Project financing contemplates that the project entity will complete the project and that the project will be self-sustaining in that future estimated revenues will be adequate to cover operating costs including the cost of debt and equity capital invested. Project revenues are usually assured by long term contracts with users who agree to pay a tariff or fee for the use of project facilities.

In the case of the System, the use of the component facilities will be offered to owners or purchasers of the gas products (shippers) for the purpose of transporting and processing the gas products. The System may enter into separate transportation and processing agreements with each of the shippers whereby the System will accept the untreated gas, transport and process it, and deliver the constituent gas products to the shippers in South Alaska. It is not assumed that the System will take title to or own the gas at any stage of the process. The shippers' obligation will be to supply the gas at the North Slope, to take delivery of the gas products in South Alaska and to pay the tariff costs for transporting and processing the gas.

As discussed previously the size and nature of any North Slope gas project raise significant questions as to completion and marketing risks. Potential lenders and equity investors will assess these risks before committing funds. Lenders will most likely insist on extra-System credit support in the form of assurances of completion by parties capable of performing, take- or-pay transportation and processing contracts, and/or guarantees of project debt by parties who are perceived by lenders as having sufficient credit to perform such obligations in the event it becomes necessary.

Therefore, from an analytical perspective, the issue will not be whether System completion and revenue assurances are necessary but rather from which parties they will be obtained. Project financing enables potential System support from parties other than System equity sponsors. Project financing can allocate risks between various parties on the basis of their interest in the System and their degree of participation.

Although it is currently unknown who potential equity sponsors of the proposed System may be, it is known which parties have or may have a direct interest in System completion. These parties include:

1) Potential Purchasers of System Gas Products - in Japan and elsewhere who may wish to diversify their sources of supply and to procure firm commitments for long term gas supplies at contracted prices from a politically secure area,

2) the North Slope Gas Producers - who may realize additional wellhead income from gas sales and enhance oil recoveries by the production of the gas,

3) the State of Alaska - both as a royalty owner of the North Slope gas and the recipient of substantial tax revenues and economic benefits from System construction and operation,

4) Other Governmental Entities - principally the Japanese government, which share the objectives of potential Japanese gas purchasers in securing stable sources of gas supply as well as contributing to balanced trade relationships.

5) Major Contractors and Suppliers - which would be interested in designing and building the component facilities or providing material and equipment, and

6) Export Financing Institutions - of nations who competitively seek projects such as the System to encourage national exports.

To the extent that project risks are assumed or accepted by financially capable parties who may have an interest in System completion but who are not necessarily equity investors, the risks of equity investment are moderated and rate of return expectations may be reduced. On the other hand, where equity investors are required not only to risk their equity investment but also provide other undertakings, they assume greater risks and may or may not be willing to provide such commitments.

Although project financing offers the potential to allocate project risks and provide debt leverage there can be no assurances that project financing can in fact be accomplished in connection with a project of the size and risk of the System. In order to accomplish a private financing it may be necessary for those parties with direct and significant interests in the gas and which will be most benefited by System operation, namely, the owners of the gas, the purchasers of the gas and other governmental entities in Japan or elsewhere, and the State of Alaska, to provide financial and investment assistance.

Although the base analyses focus on private investor financing, the analyses also evaluate the effects of State of Alaska participation in connection with tax exempt bond financing for the liquefaction facilities. The results of this analysis are set forth under the various sensitivity analyses undertaken to determine the effects on potential System tariffs.

Rates of Return on Equity

Assumptions as to equity rate of return requirements evolve from risk analysis. The more risk equity sponsors are expected to assume the higher the rate of return required. However, as previously discussed, project financing is capable of allocating certain of these risks between sponsors and other participating or interested parties. Because the precise nature and extent of the equity risk cannot be determined at the present time, the required rate of return is not clearly demonstrable.

The base analyses, therefore assume a range of rates of return which reflect in a general manner the range of risks that might be incurred by equity investors. The lower rate of return range reflects a System financing which limits equity holders' risk to actual equity investment and allocates completion assurances and debt repayment obligations to a wider group of participants and interested parties. The higher rate of return range reflects a System with somewhat greater risk on sponsors in connection with completion and debt assurances. However, since it may be unlikely that any group of private equity investors would accept total risk of System completion and debt repayment neither the lower or the higher rate of return necessarily assume full completion or debt repayment obligations by equity sponsors.

The rate of return range represents the lower tariff case and the higher tariff case in the base analyses. The rate of return in the lower tariff case represents a 30% after tax return to equity investment while the return in the higher tariff case represents an after tax return of 40% (the higher tariff case represents an after tax return on total capital invested including debt and equity of approximately 15%).

Return on equity is calculated on a discounted cash flow basis which discounts at the required rate of return all projected cash flows available for equity to a zero present value. Cash flow available for equity includes all prospective net income of the System, investment tax credits and tax savings accruing from accelerated tax depreciation as discussed below.

Prospective rates of return are calculated only on the basis of equity investment in and equity return from System investment and do not reflect potential return that might be generated by the owners of the gas from gas sales or from enhanced North Slope oil recoveries resulting from production rather than reinjection of North Slope gas.

Tax Savings/Deferred Taxes

Various federal and Alaska tax savings are assumed to be generated at the equity sponsor level over the life of the System and represents cash flow available to equity. These include organization expenses and property taxes deductible for tax purposes during the construction period and available investment tax credits. The Tax Equity and Fiscal Responsibility Act of 1982 contains language requiring the capitalization of interest during construction of certain types of property unless specifically exempted. Although it is uncertain whether the System might be exempted from capitalizing construction interest expense during construction, interest has been capitalized rather than deducted for purposes of the base analyses. To the extent that it is determined that construction interest can be immediately deducted for tax purposes additional tax savings could be generated. A sensitivity case has been calculated to show the effects of expensing construction period interest.

Tax savings generated at the sponsor level during the construction period are assumed available for construction costs. After operations commence, accelerated depreciation deductions on capitalized costs are available to sponsors as provided by the Economic Recovery Tax Act of 1981 as modified by the 1982 Act including reductions in the asset basis for 50% of investment tax credits. 100% of capital costs including capitalized interest costs during construction are assumed to qualify for 5 year tax depreciation. Based on discussions with the Committee's tax and accounting advisor, 5 year depreciation recovery has been assumed for the pipeline component on the assumption that tariff rates will not be established by regulatory procedures and the pipeline should not be a gas utility trunk pipeline. Nevertheless, a sensitivity analysis has been calculated assuming a ten year depreciation period for the pipeline.

Estimated tax savings from the System will be large and will represent a substantial source of cash flow in the early years of operations. To achieve the estimated tax savings equity sponsors must be capable of utilizing such benefits on a timely basis or such benefits must be transferred to third parties under prospective tax and leasing provisions of the 1982 Tax Act. There is, of course, no assurance at this time that sponsors will be capable of using these tax benefits as generated or of transferring them for value.

General Inflation

It is assumed that prices in general will continue to move upward during both the System's construction period and operating period. Inflation, therefore, will have a considerable impact on the System and its economics. Brown & Root estimates that general inflation in Alaska during the construction and operating periods will range between 6 and 8%. For purposes of determining System construction and operating costs the analyses assumes a 7% inflation rate throughout the construction period and the operating life of the System.

Tariff Price Path

Prospective System tariffs will be expected to provide revenue to meet all System costs. For purposes of the base analyses the System's tariff is assumed to escalate on a price path parallel to increases in LNG prices in Japan. As projected by MRI, LNG prices in Japan are projected to increase at 5% per year to 1988, and at 7% per year thereafter. This reflects a decline in real prices to 1988 and no real price increase after 1988 as compared to the 7% inflation rate assumption used in the economic analyses.

The initial System tariff in 1988 is assumed to be that tariff which, given the assumed tariff price path, will yield a stream of revenues sufficient to cover inflating operating costs and to provide a return of and return on capital investment.

Capital Structure

It has been assumed for purposes of the economic analyses that the proposed capital structure of the System and its components will consist of 75% debt and 25% equity. Significant debt leverage is traditional in pipeline financing and enables the project to reduce the total cost of capital by using tax deductible interest. Equity and debt funds are assumed invested on a pro rata basis. It has also been assumed that the debt/equity relationship will remain at the 3/1 ratio throughout the life of each case analyzed.

Modification of the initial capital structure reducing debt and increasing equity investment significantly increases costs and prospective tariffs. On the other hand, deferral of debt repayment on a level sinking fund basis rather than retiring debt early to maintain a 3 to 1 debt to equity ratio, decreases costs and prospective tariffs. Both potential changes in assumptions have been analyzed in the sensitivity analyses.

Debt Interest, Maturity and Average Life

The economic analyses assume that debt interest costs will equal 14% over the life of the System. This reflects a real interest cost of 7% over the estimated 7% inflation rate used throughout the same period. Financing costs have been assumed to constitute 1% of the principal amount of debt financed.

Both the Total System and the Phase I System assume various maturities of outstanding debt up to a maximum of twenty years after completion. Debt amortization is assumed to commence in the first year of operations which is the sixth year in both cases. During operations available cash flow after operating expenses and taxes is applied to debt amortization and repayment of equity so as to maintain a constant debt/equity ratio of 3/1.

As a result of accelerated depreciation in the early years of operation, debt amortization is not on a straight line basis and surplus cash retires debt rapidly. Approximately two thirds of total debt is repaid by the end of the first five years of operation providing an average life for System debt of approximately seven years after completion.

Depreciation

Depreciation for book purposes is computed on a straight line basis assuming a twenty year life.

Income and Property Taxes

A composite income tax rate of approximately 51% reflects Federal taxes at 46% and deductible Alaska income taxes at 9.6%. Property taxes are assumed to be 2% on depreciated book value except for the liquefaction facilities which under current Alaska law are assumed exempt from State property taxes but subject to local borough taxes of 4/10th of 1% of book value.

Throughput/Fuel Usage

Throughput represents the net amount of gas products that are expected to be transported and processed by the System in terms of Btu content after allowing for shrinkage and System fuel usage. Each cubic foot of North Slope gas put through the pipeline is expected to equal approximately 1,055 Btu's on the basis of the average Btu content of each gas product transported in the pipe line. Full capacity throughput has been assumed in the base analyses for the Total System as a result of Brown and Root and the Committee Staff's discussions with the Alaska Oil & Gas Conservation Commission and certain of the North Slope producers.

It is anticipated that a significant portion of System gas products will be used as fuel to operate the component facilities. Brown & Root estimates that approximately 12.2% of the total Btu content of the System will be lost to System fuel consumption in the Total System and 8.5% in the Phase I System. Although the estimated fuel requirement is an aggregate figure for the total System and does not necessarily reflect the same percentage in each component facility the shrinkage adjustment made in calculating component tariffs has been allocated equally between the component facilities.

Estimated System gas input on the North Slope, fuel usage and System throughput in MMBtu's per day under each case is set forth below:

Estimated System Gas Input, Fuel Usage and Throughput In MMBtu's Per Day

	Gas Input Volume MCF/d	Btu Content (Btu/cf)	Gas Input MMBtu/d	Fuel Usage MMBtu/d	Throughput MMBtu/d
Total System	2,830,000	1,055	2,986,000	365,000	2,621,000
Phase I System	950,000	1,055	1,002,000	85,000	917,000

Although the liquefaction and conditioning facilities will not operate 100% of the time due to anticipated repair and downtime they, nevertheless, will be designed with capacity and storage facilities to process 100% of the pipeline's annual throughput during their operating periods.

System Life

It is assumed that the life of each case analyzed will consist of the construction period plus twenty years of operation. Therefore, System life of the Total System will be twenty-nine years and of the Phase I System twenty-five years.

Working Capital

Brown & Root estimates that working capital requirements in 1982 dollars in all phases will approximate $10 million in connection with the pipeline, $5 million in connection with the conditioning facilities and $25 million in connection with the liquefaction facilities. These amounts are escalated with general inflation and are recovered at the end of System life.

Base Analyses Capital Costs

Using the Brown & Root unescalated System construction and organization costs and applying the assumptions used in the base analyses, the estimated inflation and financing costs during construction of each System component have been developed for both the Total System and the Phase I System. These costs represent the System's estimated capital costs and are set forth in Exhibit B and summarized in Table 1 as follows:

Table 1
Total Estimated Capital Costs at Completion
(Millions of Escalated Dollars)

	Total System (1992 Completion)	Phase I System (1988 Completion)
Pipeline	$ 14,648	$ 7,569
Conditioning Facilities	2,520	1,104
Liquefaction Facilities	8,297	2,883
Total System	$ 25,465	$ 11,556

The escalated capital costs represent the respective amounts that would need to be financed under each case. However, under the Total System case partial operations would commence four years prior to System completion and revenues and tax savings in the base analyses will repay approximately $5.0 billion of debt and provide approximately $1.7 billion of dividends to equity prior to full completion of the System. Viewed another way, should the Total System be completed and operated as scheduled under the assumptions used, financing commitments could be reduced by the amount of the cash flow generated during partial operations.

Base Analyses Revenues

Based on the estimated capital costs developed for each case the financial analyses apply the assumptions used in the base analyses over the life of the System to determine the annual tariff requirements of the System. Annual required tariff income of the System is that minimum annual stream of revenue which, over the life of the System, is sufficient to cover all projected operating costs including fuel and taxes, repay principal and interest on debt and provide the equity sponsors the required return on and return of investment.

Base Analyses Tariffs Delivered In South Alaska

The annual tariff requirement for each System component divided by the total gas product throughput on the basis of Btu content represents the tariff for each component on a unit of gas basis. Unit tariff costs are expressed in terms of dollars per MMBtu's. The sum of the prospective tariffs for each component represents the total unit cost or System tariff. The System tariff, therefore, represents the costs of transporting, conditioning and liquefying one MMBtu of LNG delivered in South Alaska and the cost of transporting, conditioning and fractionating one MMBtu of NGL products delivered in South Alaska. Tariffs are expressed in nominal dollars. Tariffs are also assumed to include the costs that the System will pay the owners of the gas for System fuel. System fuel costs are assumed to be the amount of the economic value of the gas delivered in each case analyzed. Tariff costs do not include wellhead prices for gas (other than for System fuel) or costs of shipping gas products to market.

The tariffs developed in the base analyses for each component in the lower tariff case and the higher tariff case are set forth in Exhibit C and are summarized in Table 2 in nominal dollars for the first year of operations, the last year and the average over the operating life of the System.

Table 2

Prospective System Tariffs Delivered In South Alaska

(Nominal Dollars Per MMBtu)

	Total System	
	Lower Range	Higher Range
1988	$ 4.67	$ 6.16
2011	22.14	29.20
Average	11.32	14.93

	Phase I System	
	Lower Range	Higher Range
1988	$ 5.94	$ 7.91
2007	21.48	28.61
Average	12.18	16.21

Prospective Costs of System LNG Delivered In Japan

Prospective cost of System LNG (other than wellhead prices) delivered in Japan is the total of prospective System tariffs delivered in South Alaska plus estimated LNG tanker costs for shipments to Japan as set forth in Table 3 below:

Table 3

Prospective Costs of System LNG Delivered In Japan

(Nominal Dollars Per MMBtu)

Total System

	LNG Tariffs South Alaska (Lower Range)	LNG Tariffs South Alaska (Higher Range)	Projected Shipping Costs	LNG Delivered Costs Japan (Lower Range)	LNG Delivered Costs Japan (Higher Range)
1988	4.67	6.16	1.00	5.67	7.16
2011	22.14	29.20	4.07	26.21	33.27
Average	11.32	14.93	2.20	13.52	17.13

Phase I System

	LNG Tariffs South Alaska (Lower Range)	LNG Tariffs South Alaska (Higher Range)	Projected Shipping Costs	LNG Delivered Costs Japan (Lower Range)	LNG Delivered Costs Japan (Higher Range)
1988	5.94	7.91	1.00	6.94	8.91
2007	21.48	28.61	3.19	24.67	31.80
Average	12.18	16.21	1.90	14.08	18.11

System LNG Delivered Costs in Japan Compared with Projected Japanese LNG Prices

The projected costs of System LNG delivered in Japan have been compared in the Table 4 below to MRI's projected market prices in Japan of imported LNG.

The difference between prospective System LNG delivered costs and forecasted market prices represents the potential economic value (positive or negative) of System LNG in Japan after all System tariff and shipping costs have been met. A significantly positive differential would illustrate the System's potential ability to cover all operating and shipping costs and provide a significant economic value for the LNG. Little or no differential indicates that the System may be only marginally economic in recovering System costs with little economic value for the LNG. A negative differential means that in addition to no economic value for the LNG, System costs would not be recovered unless prospective equity return was reduced.

Table 4

Prospective System LNG Costs Delivered In Japan Compared with Projected Japanese LNG Prices

(Nominal Dollars Per MMBtu)

Total System

	System LNG Costs Japan (Lower Tariff)	System LNG Costs Japan (Higher Tariff)	Japanese LNG Price Forecast	Economic Value of LNG (Lower Tariff)	Economic Value of LNG (Higher Tariff)
1988	5.67	7.16	7.89	2.22	0.73
2011	26.21	33.27	37.40	11.19	4.13
Average	13.52	17.13	19.13	5.61	2.00

Phase I System

	System LNG Costs Japan (Lower Tariff)	System LNG Costs Japan (Higher Tariff)	Japanese LNG Price Forecast	Economic Value of LNG (Lower Tariff)	Economic Value of LNG (Higher Tariff)
1988	6.94	8.91	7.89	0.95	(1.02)
2007	24.67	31.80	28.53	3.86	(3.27)
Average	14.08	18.11	16.17	2.09	(1.94)

Prospective System NGL Costs Per Barrel Delivered In South Alaska

Prospective System NGL tariffs delivered in South Alaska developed by the base analyses have not been analyzed in connection with Japanese markets but provide a basis of comparison for North Slope producers in evaluating cost estimates of alternative options of conditioning and transporting NGL products. NGL tariffs on a Btu basis are the same as LNG tariffs on a Btu basis as set forth in Table 2. On a per barrel equivalent basis, the System's major NGL products, propane and butane, could be delivered in South Alaska at the prices in nominal 1988 dollars set forth in Table 5:

Table 5

Prospective System NGL Costs Per Barrel Delivered In South Alaska

(1988 Nominal Dollars Per Barrel)

	Total System	
	Lower Tariff	Higher Tariff
Propane	$17.79	$23.47
Butane	20.50	27.04

	Phase I System	
	Lower Tariff	Higher Tariff
Propane	$22.63	$30.14
Butane	26.08	34.72

Economic Sensitivity Analyses

At the present preliminary stage of study of the TAGS proposal there remain significant uncertainties with respect to cost estimates and economic and financial assumptions in connection with a project of the scale of TAGS. It is possible that the estimated range of tariff costs projected by the base analyses could vary in substantial degree with changes in capital costs and changes in base assumptions.

Possible assumption variations which would increase the tariff include construction cost overruns, an increase in equity investment as a percentage of the capital structure, a decline in throughput in the System, ten year rather than 5 year tax depreciation for the pipeline facilities, and increases in general inflation rates, interest costs and operating and maintenance expenses.

Possible assumption changes which would decrease prospective tariffs include level debt service treatment of debt stretching out debt over a longer average life and increasing leverage, State of Alaska participation through tax exempt revenue bond financing of facilities such as the liquefaction component, a higher tariff price path and the expensing of construction period interest rather than capitalization.

Because of these potential changes the analyses review specific variations in construction costs and base assumptions in order to determine System sensitivity. The effects of variations in key assumptions on System tariffs are examined below. The sensitivity cases are compared with tariffs resulting from the base analyses of the Total System's lower range tariffs.

As the sensitivity results indicate, potential changes in construction costs and level debt service are the two most significant sensitivity cases affecting prospective System tariffs (apart from changes in required equity return assumed in the lower and higher tariff cases).

Construction Cost Overruns

The effect of a 30% construction cost overrun (which would represent a total overrun of approximately 56% because of contingencies of 20% already built into the Brown & Root estimated construction costs) on System tariffs is shown in the table below:

		Total System Tariffs Per MMBtu
Increase In Construction Costs		
30%	$	5.72
Base Analyses (Lower Range)		4.67

Capital Structure

A decrease in debt leverage and increase in equity investment resulting in a 70-30% debt-equity capital structure would have the following effect on System tariffs:

		Total System Tariffs Per MMBtu
70-30% Debt-Equity Capital Structure	$	5.07
75-25% Debt-Equity Capital Structure-Base Analyses (Lower Range)		4.67

Throughput

The effect of a 10% decrease in gas throughput on System tariffs is shown in the table below:

		Total System Tariffs Per MMBtu
Decrease In Throughput MMBtu		
(10%)	$	5.09
Base Analyses (Lower Range)		4.67

Tax Depreciation of Pipeline

The effect of ten year tax depreciation for pipeline facilities rather than five years used in the base analyses on System tariffs is shown below:

	Total System Tariffs Per MMBtu
Ten Year Tax Depreciation	$ 4.89
Five Year Tax Depreciation Base Analyses (Lower Range)	4.67

Inflation Rate for Construction, Operating and Maintenance Costs

The effect of a 1% change in the assumed rate of inflation of construction costs and operating and maintenance expenses on System tariffs is shown in the table below:

	Total System Tariffs Per MMBtu
8%	$ 4.88
7 Base Analyses (Lower Range)	4.67
6	4.48

Interest Rate

The effect of a 1% change in the assumed rate of interest on System tariffs is shown in the table below:

	Total System Tariffs Per MMBtu
15%	$ 4.78
14 Base Analyses (Lower Range)	4.67
13	4.55

Operating and Maintenance Expenses

The effect of an increase of 10% in projected operating and maintenance expenses on System tariffs is shown in the table below:

	Total System Tariffs Per MMBtu
Increase In Operating and Maintenance Expenses	
10%	$ 4.68
Base Analyses (Lower Range)	4.67

Level Debt Sinking Fund Payments

The base analyses assume that System revenues would retire invested capital on the basis of a 3 to 1 debt to equity ratio. Because of large cash flows anticipated in the early years from accelerated tax depreciation, debt repayment is relatively large in the first five years. If, however, System debt were repaid on a level sinking fund basis over twenty years debt payments would be stretched out and debt leverage increased with an improvement in System tariffs as follows:

	Total System Tariffs Per MMBtu
Level Debt Sinking Fund Payments (5% Annually)	$ 3.81
3 to 1 Debt to Equity Ratio-Base Assumption (Lower Range)	$ 4.67

Tax Exempt Financing-Liquefaction Facilities

It may be possible for the State of Alaska to participate in System financing by providing debt funds through the issuance of tax exempt revenue bonds related to System facilities. The positive effect of financing all of the liquefaction facilities by tax exempt revenue bonds is reflected in the reduction in the liquefaction tariffs and Total System tariffs as shown in the table below:

	Liquefaction Facilities' Total Tariffs Per MMBtu
Tax Exempt Financing	$ 0.84
Private Investor Project Financing - Base Analyses (Lower Range)	1.34

	Total System Tariffs Per MMBtu
Tax Exempt Financing	$ 4.24
Private Investor Project Financing - Base Analyses (Lower Range)	4.67

Tariff Price Path

The effects of a 1% increase or decrease in the price path of System's tariffs is shown below:

	Total Tariffs Per MMBtu
6%	$ 4.89
7 Base Analyses (Lower Range)	4.67
8	4.46

Interest During Construction Expensed

The base analyses assumes that the System might not be entitled to an exemption to the provision in the 1982 Tax Act which would require the capitalization of interest incurred during construction. However, because required interest capitalization is not certain and because the System's anticipated construction interest expenses will be large during the prolonged construction period, a sensitivity case assuming full deductability of construction interest during construction has been run. The effect of expensing rather than capitalized construction interest reduces System tariffs as shown in the table below:

	Total Tariffs Per MMBtu
Construction Interest Expensed	$ 4.62
Construction Interest Capitalized - Base Analyses (Lower Range)	4.67

Exhibit A1

Trans Alaska Gas System

Brown & Root

Preliminary Construction

and Organization Cost Forecast

(Millions of 1982 Dollars)

	Phase I System	Phase II	Total System
Pipeline			
Pipeline	$4,548	$6,216	$8,183
Organization	60	60	60
Total Pipeline	$4,608	$6,276	$8,243
Conditioning Facilities			
Gas Treating	76	117	155
NGL Extraction	302	463	609
NGL Fractionation	147	225	310
NGL Storage & Loading	167	167	339
Subtotal	692	972	1,413
Organization	10	10	10
Total Conditioning	702	982	1,423
Liquefaction Facilities			
LNG (Liquefaction, Storage and Loading)	1,640	2,772	4,405
Dock Facilities	193	193	193
Organization	30	30	30
Total Liquefaction	1,863	2,995	4,628
Total	$7,173	$10,253	$14,294

DILLON, READ & CO. INC.

Exhibit A2

Trans Alaska Gas System

Brown & Root

Preliminary

Construction and Organization Spending Forecast

(Millions of 1982 dollars)

Item		1	2	3	4	5	Cumulative Phase I System	6	7	8	9	Cumulative Total System
Pipeline	- Construction	$ 376	$ 434	$ 1,050	$ 1,355	$ 1,333	$ 4,548	$ 863	$ 805	$ 996	$ 971	$ 8,183
	Organization	20	20	20	-	-	60	-	-	-	-	60
Conditioning	- Construction	-	-	-	346	346	692	140	140	221	220	1,413
	Organization	4	3	3	-	-	10	-	-	-	-	10
Liquefaction	- Construction	-	-	-	917	916	1,833	566	566	817	816	4,598
	Organization	10	10	10	-	-	30	-	-	-	-	30
Total		$ 410	$ 467	$ 1,083	$ 2,618	$ 2,595	$ 7,173	$ 1,569	$ 1,511	$ 2,034	$ 2,007	$ 14,294
Cumulative Phase I System		$ 410	$ 877	$ 1,960	$ 4,578	$ 7,173	$ 7,173	-	-	-	-	$ 7,173
Cumulative Total System		$ 410	$ 877	$ 1,960	$ 4,578	$ 7,173	$ 7,173	$ 8,742	$ 10,253	$ 12,287	$ 14,294	$ 14,294

Exhibit A3

Trans Alaska Gas System
Brown & Root
Preliminary Operating and Maintenance Expense Forecast(1)

(Millions of 1982 Dollars)

	Phase I System	Phase II	Total System
Pipeline	$ 20	$ 35	$ 49
Conditioning Facilities	19	27	39
Liquefaction Facilities	39	66	105
Total	$ 78	$128	$193

(1) Excludes cost of fuel.

Exhibit B1

Trans Alaska Gas System

Preliminary Projected Capital Costs

Total System - Base Analyses

(Millions of Dollars - 1992 Completion)

	Pipeline	Conditioning	Liquefaction	Total
Construction Costs (1)	$ 8,183	$ 1,413	$ 4,598	14,194
Organization Costs	60	10	30	100
Total	$ 8,243	$ 1,423	$ 4,628	14,294
Property Taxes	980	152	94	1,226
Escalation	3,267	666	2,644	6,577
Subtotal	12,490	2,241	7,366	22,097
Interest and Financing Costs				
During Construction	2,148	274	906	3,328
Working Capital	10	5	25	40
Total Capital Costs	$ 14,648	$ 2,520	$ 8,297	$ 25,465

(1) Estimated by Brown & Root and includes 20% contingency amount.

Exhibit B2

Trans Alaska Gas System

Preliminary Projected Capital Costs

Phase I System - Base Analyses

(Millions of Dollars - 1988 Completion)

	Pipeline	Conditioning	Liquefaction	Total
Construction Costs(1)	$ 4,548	$ 692	$ 1,833	$ 7,073
Organization Costs	60	10	30	100
Total	$ 4,608	$ 702	$ 1,863	$ 7,173
Property Taxes	216	21	11	248
Escalation	1,364	258	672	2,294
Subtotal	6,188	981	2,546	9,715
Interest and Financing Costs During Construction	1,371	118	312	1,801
Working Capital	10	5	25	40
Total Capital Costs 1988	$ 7,569	$ 1,104	$ 2,883	$ 11,556

(1) Estimated by Brown & Root and includes 20% contingency amount.

Exhibit C1

Trans Alaska Gas System

Preliminary Projected Tariffs Delivered In South Alaska

Total System - Base Analyses

(Dollars Per MMBtu)

	Pipeline	Conditioning	Liquefaction	Total System
Lower Tariff Range				
Nominal 1988 Dollars	2.86	0.48	1.33	4.67
Nominal 2011 Dollars	13.57	2.26	6.31	22.14
Nominal Average Dollars	6.93	1.16	3.23	11.32
Higher Tariff Range				
Nominal 1988 Dollars	3.92	0.59	1.65	6.16
Nominal 2011 Dollars	18.63	2.80	7.77	29.20
Nominal Average Dollars	9.53	1.43	3.97	14.93

Exhibit C2

Trans Alaska Gas System

Preliminary Projected Tariffs Delivered In South Alaska

Phase I System - Base Analyses

(Dollars Per MMBtu)

	Pipeline	Conditioning	Liquefaction	Phase I System
Lower Tarriff Range				
Nominal 1988 Dollars	$3.95	$ 0.58	$ 1.41	$ 5.94
Nominal 2007 Dollars	14.30	2.11	5.07	21.48
Nominal Average Dollars	8.09	1.20	2.89	12.18
Higher Tariff Range				
Nominal 1988 Dollars	$5.42	$ 0.72	$ 1.77	$ 7.91
Nominal 2007 Dollars	19.59	2.62	6.40	28.61
Nominal Average Dollars	11.11	1.48	3.62	16.21

MARKETING

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I. Conclusions and Summary

A. Conclusions

1. The United States is late in offering North Slope LNG to the Pacific Rim's most lucrative market, Japan. Committee advisors' projections vary on the amount of LNG Japan could absorb in 1990. Projections below do not include a now-pending deal for shipment of 2.9 MMT per year from Canada to Japan:

Estimated Japanese 1990 Supply, Demand, Shortfall
(Million Metric Tons)

	Supply	Demand	Shortfall
Mitsubishi/C. Itoh	35	37	2
Mitsui	34.1	38.1	4
Marubeni	37	42-46	5-9
Sumitomo	37	39-44	2-7
MITI	34	43	9

2. Alaska's competition in the Pacific Rim market includes the Soviet Union, Indonesia, Australia, and Canada as well as a host of other prospective sellers. If the preliminary economic findings in this report are correct, Alaska is competitive against these suppliers. Action must be taken now to enter the market.

3. U.S. demand for LNG from Alaska is uncertain, as indicated by PAC Alaska LNG Associates' recent decision to defer bringing Cook Inlet Alaskan gas to California.

4. Petrochemical markets, now glutted world-wide, may offer a long term opportunity for Alaska supplies and in-state processing.

5. Estimated shipping costs to serve Asian markets vary widely depending whether now mothballed U.S. ships are used, new Japanese or Korean ships are constructed, or U.S. Jones Act ships are built. Delivered in Japan the range of tariffs runs from .47 per MMBTU to $1.11.

B. Summary

For this report, the Governor's Economic Committee is relying on the advice of several American and Japanese companies in the business of producing, trading, and shipping energy. The committee has benefitted from conversations with government officials on both sides of the Pacific.

Natural markets for North Slope gas delivered to tidewater exist in the industrialized Pacific Rim nations. These nations include Japan, Korea and the West Coast of the United States. In the United States, gas reserves in the Lower-48 states and supplies deliverable from Canada and Mexico are expected to meet demand through the end of the century. Pacific Alaska LNG Associates, who have commitments to bring LNG into California from Cook Inlet Alaska and Indonesia, have postponed operations until at least 1990.

The committee has concluded after investigation that North Slope producers should focus on Japan as the major market, though not the only market, for their gas. Phase I of TAGS would make available approximately 4.8 million tons of LNG in 1988. Phase III, the total system, would increase TAGS throughput to 14.5 million tons. Estimates of Japanese need beyond those sources already committeed range from 2 to 9 million tons in 1990 and 9 to 17 million tons in 1995. Thus, there is a window open yet for Alaskan supplies by the end of the decade. That window will close tightly if the United States does not act soon. Competition from Canada, Australia, Indonesia, and the Soviet Union — each of whom have at least two years' lead time in approaching the market — is such that projected demand in Japan may already be met until after 1990.

C. United States Energy and Trade Policy

Except for Canada, where export contracts have not been ratified, each of those competing nations carry an additional advantage at present: the full support of their governments. While the United States has needed to find large value exports to balance its trade with Japan in recent years, energy policy in the United States has built a wall around its borders. Potential Asian trading partners have been forced to look elsewhere. While Japan and Korea have answered OPEC generated oil shocks with attempts to diversify supply, requests that the United States sell oil and gas have been rebuked under America's policy to establish "energy independence" at home. Such a policy might have made sense at a time of rising prices and uncertainty about supply. But today, in a time of declining oil prices and shut-in gas wells throughout the United States, exploration — the lifeblood of an energy independence policy — is depressed as well. A free American market in energy could spur exploration again by involving new investors and markets. Regardless of whether the United States can use new Alaska oil and gas finds immediately, it benefits both the United States and its trading partners outside OPEC to keep on looking. Establishment of a North Slope gas transportation system before 1990 will keep that process on schedule.

Two facts provided by oil companies operating in Alaska help show how bringing gas to a market will further America's goal of energy independence. At Prudhoe Bay today, a number of high gas-oil ratio wells are not produced because of the economic costs of reinjecting the gas. Once gas shipments begin, testimony indicates, 100,000 additional barrels per day of Prudhoe oil can be produced.

Costs of gas reinjection give North Slope gas a negative value to its owners today, assuming alternative methods are available for secondary oil recovery. Only a transportation system can give the gas a value. Recent bidders on oil exploration tracts in the area have told the Committee that the possibility of finding gas on Arctic tracts is high enough that there is a substantial chance a discovery well will not be producible without a gas transportation system. Bid prices have been discounted accordingly and some areas with known gas reserves have produced little leasing interest at all.

If America's energy policy calls for its government to advocate the export of Alaska gas, America's foreign policy as a matter of trade and national security does so as well.

In trade policy, a massive balance of trade deficit with Japan gives the United States both need and leverage to work with the Japanese for a remedy. This project can be part of that remedy, and useful for both nations.

As a matter of national security, the United States has recently expressed strong concern to the Soviet Union's neighbors on both sides of the Eurasian continent that free world nations do not unduly rely on the Soviet Union for energy. Save for American attempts to export more coal, this country has been slow in offering either our NATO or SEATO allies an alternative. Alaska North Slope gas represents an alternative to Soviet Union gas from the Sakhalin Island, which is scheduled for marketing in 1989, one year after the Alaska project could be on line. Under the TAGS schedule, Alaska can beat Sakhalin to market.

As Japan and other Asian nations have sought to diversify sources of energy, commitments from abroad have brought about more than just commercial relationships. If the United States continues to refuse to participate in the Pacific Rim energy supply picture, it may see its Pacific partners realign in other areas as well. Political interdependence, helpful for national security, often follows commercial interdependence.

D. Japan's Energy and Trade Policy

A May, 1982 report on the LNG market in Japan by Marubeni Corporation provided the following description of Japanese government policy toward LNG.

It is a fundamental policy of the Japanese Government to pursue a stable supply of energy to promote the public welfare and national security. Environmental aspects must also be considered. To achieve the policy, the following measures are slated:

1. Securing a stable supply of oil.
2. Promotion of energy conservation

3. Promotion of development and introduction of alternative energies
4. Promotion of siting for electric power plants
5. International cooperation

It is resolute for the Japanese Government, as mentioned above, to pursue the promotion of development and introduction of alternative energies to reduce dependence on oil. In October, 1981 the government established the "New Energy Development Organization" and charged it with responsibilities (1) to develop technology for new energies, such as coal liquefaction and solar energy, (2) to develop geothermal resources, and (3) to develop overseas coal resources. The May 1980 law which came before this organization furthermore covers nuclear energy, hydro power, and LNG.

LNG is regarded as a fuel having long-term security of supply, when compared with oil, and is expected to play a major role among alternative energies, together with nuclear energy and coal, through use in electric power and gas industries. In the future, especially, LNG is assumed to be increasingly consumed in the town gas industry through (1) resale of gas by LNG importers to smaller gas enterprises and large industrial consumers and (2) spread of gas air-cooling systems nationwide.

To encourage faster introduction of LNG into Japan's energy framework, the Japanese Government has adopted the following policies:

Immediate Policy

1. Aid for exploration, development and production
   a. Aid by Japan National Oil Corporation (JNOC). Under legislative provisions established in 1972 governing the activities of JNOC, JNOC is permitted to provide financial aid to gas exploration and development ventures in the form of equity capital and loans. Guarantees of obligations can be obtained from JNOC for production of

LNG. JNOC was authorized in Fiscal Year 1982 to provide 140 billion yen (about US $600 million) of financial aid and 1 billion yen (about US $4 million) of guarantees of obligation.

b. Credit by The Export-Import Bank of Japan (EXIM Bank). By co-financing with commercial banks the EXIM Bank extends credit to exporters to provide them with funds necessary to cover their deferred payment credits in connection with liquefaction plant construction. The EXIM Bank had in FY 1982 a budgetal frame of 312 billion yen (about US $1.3 billion) to promote imports to Japan.

c. Loans by the Development Bank of Japan (DBJ). The Government's Shipbuilding Program includes in FY 1981 loans of 117 billion yen (about US $500 million) by the DBJ coupled with government interest subsidies of 6.63 billion yen (about US $28 million). The 1981 program allowed construction of three LNG tankers, 600,000 gross tons of energy-resources transportation vessels, and other 300,000 ton vessels.

2. Exemption of import duty for LNG. To encourage the import of LNG the Government exempts import duty, a basic tariff of 20%.

3. Aid for LNG facilities. To prevent pollution and to improve individual life, the Development Bank of Japan offers loans to electric power companies for construction of LNG-fired power plants and to gas companies for construction of LNG receiving terminals.

The DBJ also makes available to LNG consumers credits for construction of LNG related facilities, such as pipelines for the exclusive use of regasified LNG, and installation of industrial furnaces and boilers being fueled by regasified LNG.

4. Special tax arrangements. LNG consumers are allowed to choose either a 7% tax deduction or a 30% special depreciation rate for their accounting in connection with LNG related facilities and equipment.

5. Special contract rate for large industrial LNG consumers. The rate is now around 7-8 yen per 1,000 kcal (about US $7.35/MMBTU), which is almost equivalent to rates for kerosene and light fuel oil.

6. Subsidy for studies. Subsidies are extended to local governments to study the possibility of introducing of LNG into local industries and to study siting and environmental issues of a receiving terminal and secondary transportation. In FY 1981 the amount of 85 million yen (about US $350,000) was provided.

Policy Toward The Future

1. To progressively develop and maintain good diplomatic relations with exporting countries, which will contribute to the security of long-term supply of LNG.

2. To enrich conditions of loans associated with construction of liquefaction plants by EXIM Bank, JNOC and Overseas Economic Cooperation Fund (OECF) in favor of LNG consumers and also to enrich the condition of guarantees of obligation extended by JNOC.

3. To arrange low-interest-financing and favored tax mechanisms for construction of LNG receiving terminals.

4. In order to facilitate siting of LNG receiving terminals and LNG-fired power plants, the government:

   a. promotes policies to form agreement of surrounding and local people on the safety of LNG and the necessity of its introduction.

b. establishes fine-grained siting policies which suit to each specific location.

5. In order to meet regulations for reclamation and for navigation the government makes certain:

   a. thoroughly advance surveys on safety and environment are performed.

   b. a structure which coordinates concerned institutions and parties is established.

6. To strengthen the system of governmental aid in order that Japanese building of LNG tanker construction and possession and operation of LNG tankers by Japanese shipping companies is internationally competitive with those of advanced countries, and to promote a structure for cooperation of concerned business circles.

7. To examine a domestic system of LNG receiving corresponding with a "take or pay" clause which is common in LNG supply contracts.

8. In order to expedite more use of LNG in gas enterprises and other industries, to strengthen measures of governmental aid for laying pipelines to connect with existing LNG pipelines and for changing in heat value, and examine structures to collect small demands together to supply LNG at low cost.

II. North Slope Supplies Made Available by TAGS

For the purpose of facilitating the entry of North Slope gas on the world market as well as making financing easier for the project as a whole, the Trans-Alaska Gas System has been envisioned in three phases, with varying throughputs available.

	Phase I	Phase II	Phase III
Online	1988	1990	1992
Raw gas/ mmcfpd	950	1750	2830
LNG/Million Metric Tons per year	4.8	8.9	14.5

Additionally, the pipeline will make available substantial quantities of gas liquids besides the methane and ethane contained in the figure above. All quantities are listed in 42 gallon barrels.

	Natural Gas Liquids Available (Barrels Per Day)		
Propane	19,000	35,000	56,600
Butanes	10,450	19,250	31,130
Pentanes Plus	8,550	15,750	25,470

III. Prospects of Demand and Supply of LNG in Asia

A. Present Situation In Japan

The Japanese economy's growth rate has dropped to around 3 percent in recent years with considerable sluggishness in steel, petrochemical and other energy intensive industries. Due to decreased growth and conservation measures, demand for energy has been almost level in Japan for the last three years.

Amid overall stagnancy in energy demand, LNG consumption has shown a steady increase because the power industry and city gas suppliers, two major users of LNG, have moved to replace oil with LNG.

Japan's annual LNG consumption is currently 17 MMT (Million Metric Tons,) of which 75 percent is consumed by the power industry, 21 percent by city gas suppliers and 4 percent by steelmakers.

Under these circumstances, Mitsubishi Research Institute and C. Itoh, collaborators for this section of the report, regard the following two issues as important factors in making a forecast for LNG demand in Japan:

1. Prospects of overall demand for electricity and city gas, which is associated with future economic growth rates.

2. The degree to which these two industries will depend on LNG as opposed to other forms of energy. For instance, electric power can be generated from coal, hydro, nuclear and oil as well as domestic natural gas and imported LNG.

B. Prospects For Japan

1. Government's Forecast and Its Problems

The Japanese Ministry for International Trade and Industry (MITI) announced in May, 1982 the Long-term Forecast on Demand and Supply of Energy by 2000. The forecast said that:

a. The Japanese economy will grow at an average annual rate of 5 percent until 1990, and at 4 percent for the next 10 years.

b. Overall demand for energy in oil terms will rise at an average annual rate of 3.2 percent from 429 million kiloliters (MKL) (68.2 million barrels) in 1980 to 590 MKL (93.8 million barrels) in 1990 and will increase 2.7 percent per annum during the next 10 years to 770 MKL (122.4 million barrels) in 2000.

c. Meanwhile, demand for electricity (which is closely associated with demand for LNG), will show an average growth rate of around 4 percent during 1980-2000 and demand for city gas, which is covered only implicitly in this forecast, will presumably grow at some 4.5 percent during the period.

d. As a result, total demand for LNG will show a steep rise from 17 MMT in 1980 to 43 MMT in 1990, and further to 50 MMT in 2000.

The chart on the next page shows the forecast for Japan's LNG supply and demand based on the MITI's long-term energy supply and demand forecast. The supply quantities shown in this figure are all contracted or quasi-contracted quantities as of April 1982. Canadian LNG is excluded from the chart since the supply of LNG from Canada is still subject to the approval of the Canadian National Energy Board (NEB) at the present moment.

According to MITI, the 43 million MT of demand in 1990 will consist of 31.5 million MT of demand from electric power companies and 11.35 million MT of demand from gas companies. (The balance of 150,000 MT represents demand from miscellaneous users.)

The chart indicates that there will be 8.8 million MT/year of demand for LNG in excess of contracted or quasi-contracted supply quantities in 1990, 17.44 million MT/year in 1995 and 31.5 million MT/year in 2000. Should the export of Canadian LNG be approved by the NEB, these figures will require a 2.9 million MT/year downward adjustment.

However, due to trends in the Japanese economy since the April, 1982 projections, including the unexpected low growth of electricity and gas demand, additional downward revisions in the MITI's forecast appear necessary. Those revisions, if they are forthcoming, have not yet been announced.

It was recently reported that economic growth during 1983-1987 would be revised downward to the level of 3% per annum, although 5.0% was the level assumed in MITI's latest forecast. The electric power industry experienced surprisingly low growth in demand for electricity during April-August 1982, with an annual growth rate of only 0.5%, in comparision with a 4.4% growth rate expected by the electric power industry at the beginning of 1982.

This low growth of electricity demand has resulted partly from relatively cool weather during the summer of 1982, but there is no doubt that it also reflects the further strengthening of trends in Japanese industry toward less energy-consuming products, and consequently, this tendency toward reduced electricity demand growth can be expected to continue.

It must be noted, therefore, that the government's forecast is, in its nature, something like a target toward which efforts should be made. Thus, Mitsubishi Research Institute provided the Committee with a separate forecast.

C. Forecast by Mitsubishi Research Institute

1. Mitsubishi Research Institute Forecast
   a. The Japanese economy will grow at an average annual rate of 3 percent in 1980-90 and 2 percent in 1990-2000.

   b. Overall demand for energy will rise at an average annual rate of 1.5 percent in 1980-90 and 2 percent in 1990-2000.

   c. Growth in electricity demand will be 2.6 percent annually in 1980-90 and 2 percent in 1990-2000, considerably lower than government's forecast, because electricity demand will experience a firm increase in households while it will level off in industries. Demand for city gas is expected to record a little higher growth than that for the power industry with an average annual rate of 3.6 percent for 1980-90 and 2.5 percent for 1990-2000. Both rates are fairly lower than Government's forecast.

   d. City gas suppliers have launched a project aimed at raising pipe transportation efficiency by switching to higher-calorie natural gas to reduce dependence on oil and rely more on natural gas considerably by 1990. This project is going well and the project will be completed around 1990. After 1990, however, dependence on LNG will

FIGURE-2 FORECAST OF JAPANESE LNG SUPPLY AND DEMAND

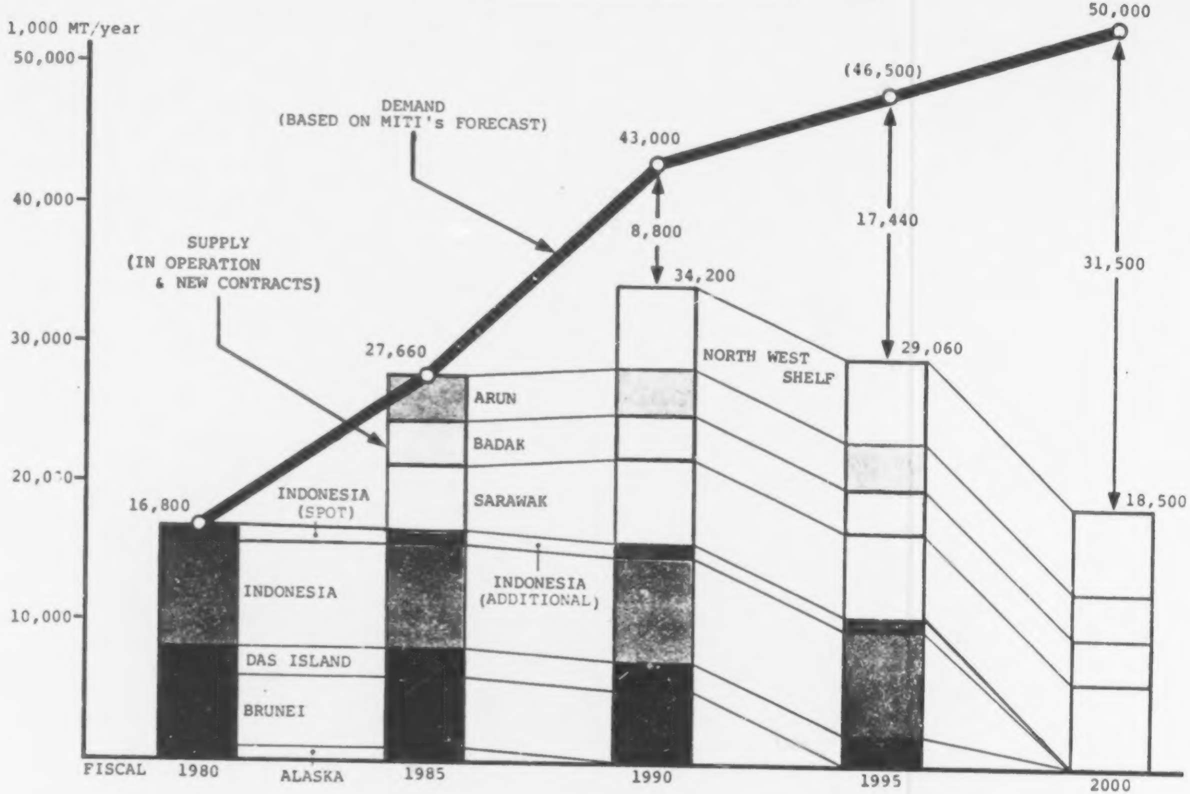


Chart Source: Mitsui & Co., LTD

not increase sharply. Typical LNG projects deliver constant supplies year-round, rather than meeting seasonal ups-and-downs in city gas production. Thus LNG dependence will match base load demand growth. As well, city gas, which is made from LNG, is supplied only in and around big cities.

e. The power industry plans to build many LNG-burning plants and is also making provision for necessary LNG supply. After these plants are constructed, overall generating capacity of LNG-burning plants will come to 37.6 BW (Billion Watts) in 1990, up from 19.7 BW in 1980. LNG-burning plants' share will rise to 24 percent in 1990 from 15 percent in 1980 in generating volume terms. After 1990, however, Mitsubishi Research Institute does not expect the share to show a sharp increase. There are following two reasons:

(1) The power industry presently depends for its base load, which shows no seasonal and daily fluctuations, on nuclear, hydroelectric and LNG-burning plants. From the viewpoint of economic benefits, however, the power industry gives the priority to nuclear and hydroelectric plants. A substansial increase in LNG cannot be expected, because it causes operational difficulties to meet the medium load, which shows seasonal and daily fluctuations.

(2) As LNG is priced the same as oil in calorie-equivalent terms, and LNG-burning plants also require huge investments for construction of receiving terminals and trunk lines, etc., LNG-burning plants may not offer much economic benefit compared to oil-burning plants.

f. Taking these analyses into account, Mitsubishi Research Institute's forecast LNG demand in Japan is below:

LNG Forecast Demand for Japan
by Mitsubishi Research Institute
(Millions of Metric Tons)

	1980	1990	2000
Power Plant	13.0	28.2	35.0
City Gas	3.4	8.2	10.4
Others	0.6	0.6	0.6
Total	17.0	37.0	46.0

D. LNG Development Projects

1. Supply to Japan

a. Volume of LNG to be supplied from existing projects and other projects to start operations by 1990

(1) Existing Projects
There are four projects in Alaska, Brunei, Abu Dhabi and Indonesia which are supplying LNG to Japan.

Under the contracts, they ship a total of 15.7 MMT LNG to Japan a year. Among them, Alaska and Indonesia projects deserve special explanation.

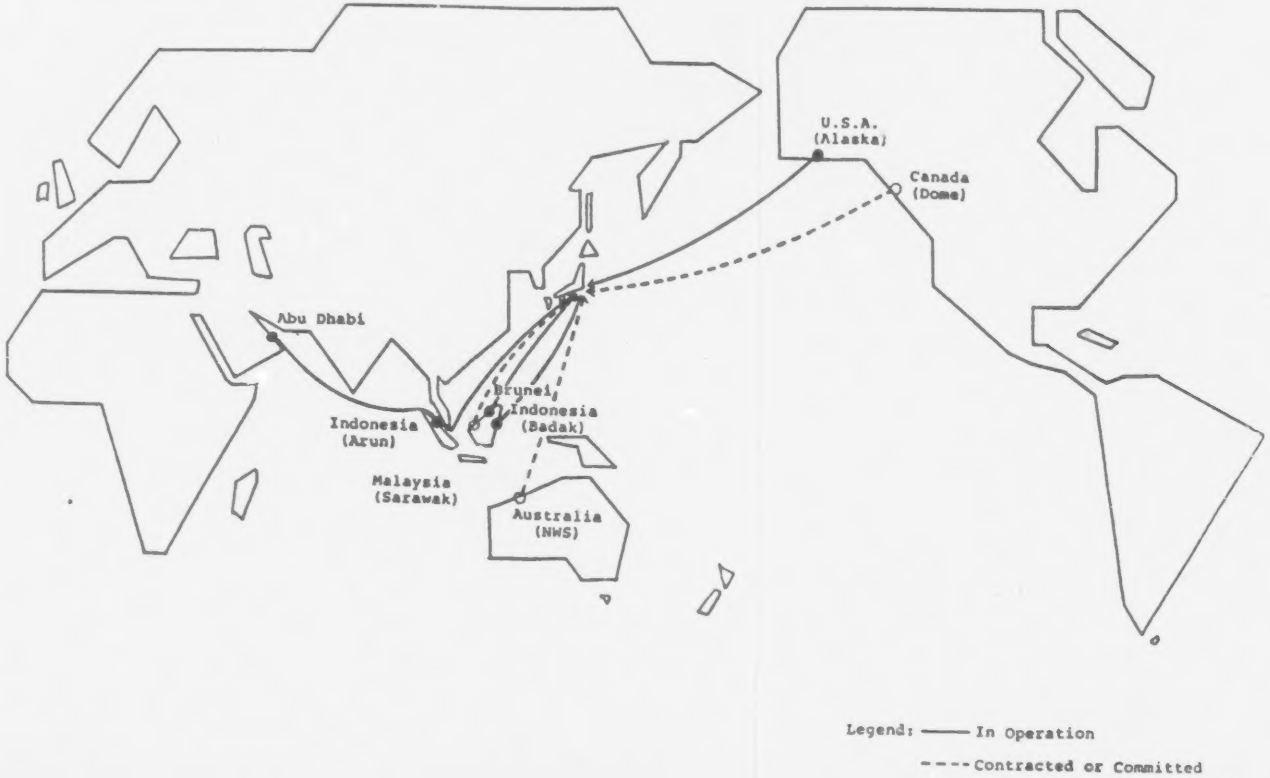
Alaska The supply contract is to expire in 1984, but five-year extension of the deal has been agreed between the both sides and they applied to the Department of Energy (DOE) for export permission. DOE is expected to give the permission soon.

Indonesia is providing Japan with LNG which exceeds contracted volume of 7.5 MMT a year. In 1983, it will supply an additional 1.5 MMT.

(2) Projects to Start Operations by 1990
Malaysia, Indonesia (Arun and Badak), Australia and Canada are scheduled to provide Japan with a total of 21.4 MMT a year.

1. LNG Projects for Japan

(In Operation, Contracted and Committed)


U.S.A.
(Alaska)
Canada
(Dome)
Abu Dhabi
Brunei
Indonesia
(Badak)
Indonesia
(Arun)
Malaysia
(Sarawak)
Australia
(NWS)
Legend: ——— In Operation
- - - - Contracted or Committed

Malaysia is scheduled to enter into full operation four years after starting operations in January, 1983. At present, the project is in the final construction phase and final negotiations are going on between suppliers and purchasers. The project is expected to provide Japan with 6.0 MMT a year.

Indonesia The basic contract, signed in April, 1981, between PERTAMINA and Japanese customers, provided that Japan will import 3.3 MMT a year from Arun and 3.2 MMT from Badak. The two plants and LNG-carriers are under construction.

Australia Memorandum of Intent was signed in July, 1981. Negotiations are under way over detailed conditions for the contract. The project is expected to ship 6.0 MMT a year to Japan.

Canada The project calls for a supply of 2.9 MMT a year starting around 1986. An application for export permission has been filed with the Canadian Government. The decision will come sometime in 1983.

(3) Possibilities of Project Now Under Examination, Being Materialized

The following four projects are now under study to supply LNG to Japan.

Sakhalin The Japan-Soviet joint project envisioned that 3.0 MMT will be shipped to Japan annually for 20 years from Chaivo offshore gas field off north-eastern Sakhalin. In August, 1982, the Soviet Union formally confirmed the volume of gas and oil reserves there and the development plan is being shaped. The Soviets hope to start supplying LNG by 1989, but due to a low-growth rate of LNG demand in Japan, it is likely that shipments will begin only after 1990.

Qatar has a plan to supply 6.0 MMT a year for 20 years to Japan from North Field off northern Qatar. QGPC is selecting a partner among foreign oil companies. QGPC had planned to start production in 1987, but there will be a big delay in the plan due to sluggish demand in Japan and Europe.

Thailand plans to export 2 to 3 MMT for 20 years to Japan or South Korea from an offshore gas field on the Gulf of Thailand. In July of this year, the Thai Government decided on the basic policy on natural gas exports and is selecting joint venture partners.

Indonesia plans to supply 6.0 MMT a year to Japan from D-Alfa concession field around Natuna Island. Although 75 percent of the gas exploited is carbon dioxide (CO_2), the bulk of gas reserves are expected. At present, EXXON is exploring the field.

Among the above four projects to be carried out after 1990, the total volume to be produced off Sakhalin will be shipped to Japan because of its nature as a government-level project. Therefore, Qatar, Thailand and Indonesia (Natuna) will compete with Alaska in the Far East.

The following chart summaries the LNG demand projections of MITI, Mitsubishi Research Institute, and other firms with expertise in the Japanese market contacting the Committee. From those figures the Committee has estimated the shortfall in committed supply which TAGS might fill:

Supply and Demand for LNG in Japan

(Millions of Metric Tons)

	1990		2000	
	Demand	Shortfall	Demand	Shortfall
MITI	43	9	50	31
Mitsubishi/C. Itoh	37	2	46	10-27
Mitsui	38.1	4	-	-
Marubeni	42-46	5-9	53-58	14-28
Sumitomo	39-44	2-7	-	-
Range	38.1-46	2-9	46-58	10-31

Shortfall figures for 1990 do not take into account the pending deal between Canada and Japan which would ship 2.9 MMT per year beginning in 1986 if the project is approved.

Higher ranges in the shortfall figures for 2000 assume that current contracts for delivery of LNG which expire before that time will not be extended.

After assessing the uncertain projections of supply and demand for Japanese LNG, Mitsubishi Research Institute concluded the following:

> "To raise marketability of North Slope gas, it will be proper to stress its merits over other competing projects. Although it will be needed to set attractive conditions in the contracts, it will far more necessary to emphasize such allures that the project will contribute to an improvement of Japan-U.S. trade imbalance, that it may trigger a relaxation of curbs on domestically-produced oil and that it offers unparalleled political stability as a supply source of LNG."

E. Projected Prices for LNG Landed in Japan

In order to establish a sense of TAGS economic feasibility, it was necessary to have estimates of the prices LNG will command in Japan in years to come.

Traditionally, LNG in Japan is priced at a calorie equivalent to oil. Oil prices, at the time of this study, faced continued uncertainty. Mitsubishi Research Institute provided the following estimates of oil and LNG prices, in nominal dollars, based on a conversion factor of 5.85 MMBTU's per barrel of oil. LNG prices are exclusive of regasification costs after landing in Japan.

YEAR	JAPANESE CRUDE PRICES	JAPANESE LNG PRICES
1982	$ 34.52	$ 5.90
1983	34.21	5.85
1984	35.50	6.07
1985	37.70	6.44
1986	40.34	6.90
1987	43.16	7.38
1988	46.18	7.89
1989	49.42	8.45
1990	52.88	9.04
1991	56.58	9.67
1992	60.54	10.35
1993	64.78	11.07
1994	69.31	11.85
1995	74.16	12.68
1996	79.35	13.56
1997	84.91	14.51
1998	90.85	15.53
1999	97.21	16.62
2000	104.00	17.78

F. Prospects of Demand and Supply of LNG in South Korea and Taiwan

1. South Korea — Present Situation

Korea Electric Power Corporation has agreed with PERTAMINA, Indonesia's state oil corporation, to import 1.6 MMT of LNG annually, produced in Arun, for 20 years starting from the middle of 1985. Later, the presidents of the two nations promised to add annual imports of 1.4 MMT of LNG for 1987 and afterwards. This plan was recently prolonged by two years with revised annual import volume of 2.0 MMT in and after 1987 and additional 1.0 MMT to be contracted from Indonesia for 1989 and later.

As is the case in Japan, LNG will be consumed in the power industry and city gas sector in South Korea. KEPCO will modify Pyeongtaek and Inchon Thermal Plants to burn LNG as well as oil. By 1987, four units with generating capacity of 350 MW each of Pyeongtaek Plant and two units with 250 MW each of Inchon Plant will be converted similarly. The remaining two units with 325 MW each of Inchon Plant will be modified by the end of 1989. As a result, generating capacity of LNG plant will increase to 2.55 BW by the end of 1989.

Of the 2 MMT to be imported from Indonesia, 1.6 MMT will be priced at $5.78/MMBTU on F.O.B. basis and the rest remains undecided.

2. South Korea — Prospects

The Energy Forecasts by 1991, compiled by the South Korean Government, show a basic policy under which alternative energy sources, mainly nuclear energy, will be actively developed to reduce Korean dependence on oil. As for LNG, the demand in 1991 is set at 3.0 MMT and this corresponds with the prospective import volume from Indonesia, as seen in 2-1.

According to the forecast, LNG demand in the power industry will be cut to 1.9 MMT in 1991 from 2.7 MMT in 1989, while that from households will increase to 1.1 MMT from 0.3 MMT, because excessive LNG will be converted for household use after a nuclear power plant starts operation. This indicates city gas suppliers' positive attitude towards introducing natural gas. Therefore, in the 1990s if construction of nuclear power plants is badly behind schedule or gas demand from households and industry firms up, there is a possibility that additional 1.5 MMT of LNG will be needed.

Energy Forecasts of the South Korean Government

	1982		1991	
Oil (million b.p.d.)	0.4348	(59.4%)	0.605	(43.6%)
Imported LPG (MMT)	0.2	(0.8)	1.0	(2.3)
LNG (MMT)	0		3.9	(4.9)
Coal (MMT)	30.7	(36.9)	49.2	(34.7)
Hydroelectric (MW)	249	(1.4)	494	(1.3)
Nuclear (MW)	352	(1.7)	5110	(13.2)

3. Taiwan

There is little information on LNG in Taiwan available. Annual natural gas production is estimated at 1.67 billion cubic-meters (59 billion cubic feet) against confirmed reserves of 24 billion cubic-meters (847 billion cubic feet) and, if production continues at the present level, the country's reserves will be exhausted in 15 years or so.

Taiwan plans to increase natural gas production sharply in 1985. If the plan fails, there will be a possibility that Taiwan will introduce LNG at an earlier date than expected.

At present, it is supposed that Taiwan will have LNG demand of 1.0 MMT, equivalent to the present natural gas production level, around 2000.

4. Prospective Supply to South Korea and Taiwan

Indonesia agreed to supply LNG to South Korea. When LNG demand will increase considerably in South Korea and Taiwan, the two countries are now expected to view some of these projects — Qatar, Thailand and Indonesia (Natuna) — as supply sources.

As the LNG demand in Japan is predicted to increase at a slower rate than initially expected, it will be difficult for Japan to import all the volume to be produced in Qatar and Indonesia (Natuna) during a period since they will have large production capacity of 6.0 MMT each. Therefore, it will be highly possible that some of the LNG will be shipped to South Korea and Taiwan.

Although South Korea is talking with Thailand on LNG imports, Thailand's 3 MMT's will be too large to be imported solely by South Korea. Therefore, Thailand may seek its export possibility not only to South Korea but also to Japan.

IV. The American Market for North Slope Gas

A. Alaska

While expected levels of demand in Alaska are small to the point of insignificance in adding to the financial viability of the Trans-Alaska Gas System, the system itself can make a large contribution to solving Alaska's needs for home heating fuel and electric power generation. At the same time, proponents of value-added industries in the state have forseen the use of North Slope methane and gas liquids for creation of products such as methanol for export.

Coincident with this study by the Governor's Economic Committee, the Alaska Power Authority and Ebasco, its consultants, have looked at the use of North Slope gas for instate power generation.

Fairbanks, Alaska's second largest city, is in dire need of low cost power. This project would make gas supplies available to the community for power generation. Gas can also be used as a feedstock for added value processing, such as in a methanol facility. Methanol could be used in motor vehicles and other internal combustion engines in Alaska or exported.

Anchorage's home heating needs and electric power generating capacity are currently met by gas production from the Cook Inlet. However, over the life of TAGS, North Slope gas could make an economic contribution.

Other cities and towns in the state could potentially be served by either the Alaska Power Authority's proposed intertie between Anchorage and Fairbanks or through shipments of less volatile North Slope gas products such as propane in rail tank cars, ships along the coast, or barges in the river system.

B. The Lower 48 States

Two possible sites to bring LNG from Alaska into the West Coast have been brought to the Committee's attention as having potential to receive large scale ships and to hook into currently existing U.S. pipeline systems. Overall demand in the short term from each of these areas looks small today, but eventual changes in the U.S. demand picture for LNG could be met in this manner.

1. Point Conception

Pacific Alaska LNG Associates has spent a total of almost 400 million dollars to design, engineer and gain permits for a project which would establish an LNG receiving terminal with connection to existing natural gas trunk lines, near Point Conception, California.

Although the company recently received a final siting approval from the California Public Utilities Commission (CPUC), it has filed with the CPUC to have the project "preserved for future use". The company indicated that California's natural gas needs are currently being met from lower 48 sources, along with some Canadian and Mexican supplies. It reported the project is scheduled to begin construction in 1986 for completion in 1990 and that sources of LNG in addition to those contracted from Alaska's Cook Inlet will be sought to feed into the California receiving terminal.

Currently PacAlaska LNG has secured 144 million cubic feet per day or slightly over two thirds of the reserves necessary to cover the first phase of 200 MMCFD. The second phase is scheduled to process an additional 200 MMCFD. No contracts have been signed to supply any part of the phase two demand. In addition to the scheduled Alaska supply, Pac Alaska LNG has signed a letter of agreement (due to expire in 1983) with Indonesian sources for approximately 555 MMCFD.

The proposed terminus has a processing limit, under California law, of 1.3 billion cubic feet per day. Of this total limit, supply commitments total 644 MMCFD.

Assumming Indonesian commitments hold, therefore a window of 656 mmcfd would exist for North Slope gas or other supplies to reach the limits of the facility. Uncertainty continues, however, as to whether the California market will present prospective demand in 1986 to bring about any financing and construction of the PAC Alaska project.

2. Port of Bellingham

Bellingham, Washington has, for the past 20 years, sought to serve Alaska as a southern terminus for a major transportation system joining Alaska and Washington.

In connection with the committee's work authorities of the Port of Bellingham have requested that it be considered as a potential terminus in the Lower 48 to receive LNG shipments from the proposed Trans-Alaska Gas System.

The Port's Cherry Point area has several features necessary for the siting of a major receiving terminal. Those features include deep water close ashore, large upland sites, heavy impact industry zoning in place, and industrial utilities. As a primary additional feature, the site is currently served with a 16" diameter high pressure natural gas pipeline connecting to the natural gas grid system serving much of the Pacific Northwest.

V. The Petrochemical Opportunity

Alaska has a number of unique features which can attract petrochemical development to serve the entire Pacific Rim. Just as the Gulf Coast of Texas and Louisiana has made those states providers to the Atlantic family of nations and their need for petrochemicals during the last generation, Alaska has the potential to compete as a "Gulf Coast of the North" to provide for the next generation in the Pacific.

Among the features which lead to the possibility of petrochemical development in Alaska are:

1. The immense size of the North Slope gas reserves. At 26 trillion cubic feet, Prudhoe Bay has the largest quantity of gas in a single place on the continent.

2. The availability of an adequate supply of fresh water for processing.

3. The availability of large tracts of land which are suitable for plant development.

4. The State's geographic position, halfway between the United States and Asia, and its ability to serve both markets.

The North Slope natural gas reserve is rich in natural gas liquids (NGL). These liquids include ethane, propane, and butane which are the key petrochemical feedstocks today and for the future.

A. Ethylene Production

The initial phase of petrochemical development would be the construction and operation of an ethylene plant. While all natural gas liquids are excellent petrochemical feedstocks, ethane is expected to be the most attractive component for petrochemicals in Alaska. Ethane produces a higher yield of ethylene based products than propane and butane. An ethylene plant would be the key unit of a petrochemical industry. Potential byproducts from first phase processing at an ethylene plant would include:

Ethylene	Ethylene Glycol
Polyethylene	Ethylbenzene
Ethylene Dichloride	Polystyrene

Downstage processing creates a multitude of products ranging from polyester resins to plastics, as detailed in the accompanying fold-out exhibits.

The 1981 Dow-Shell Study of the feasibility of establishing a petrochemical industry in Alaska summarized demand and capacity projections for ethylene in the Pacific Rim. Those findings are reprinted as follows:

1. "There should be a need for additional ethylene capacity (with associated derivatives) by the late 1980's to supply the Pacific Rim markets — western U.S. and Canada, the Far Eastern and Southeast Asian countries, Mexico and the western part of South America.

2. "The major areas requiring imports of ethylene derivatives will be Japan and the Asian countries.

3. "Major areas with export capability will be the Mid-East and Canada — both based on relatively low cost feedstocks — and the U.S. Gulf Coast.

4. "Mexico and South America are seen as short-term exporters of a few petrochemicals, although internal and regional demand should consume most of their increases in capacity.

5. "The Australian area is expected to be in balance, although some potential would exist for export of a few products from Australia after 1985.

6. "The Indian sub-continent is forseen to continue in balance — neither a supplier of ethylene nor a significant market."

B. Japanese Market

Japan's current imports of natural gas liquids, primarily liquified propane and butane (LPG), has increased steadily and is projected to continue increasing.

LPG IMPORTS BY JAPAN

1980	10 million metric tons
1982	11.5 million metric tons
1990E	20 million metric tons

Potential TAGS gas liquids (LPG production)

Phase 1	Phase 2	Phase 3
1.1 Million MT	1.9 Million MT	3.0 Million MT

Includes propane, butane, pentanes and heavier.

From table 5, of Dillon, Read's economic report where costs of a pipeline tariff and fractionation of natural gas liquids were estimated, the figures have been converted here into metric tons.

Prospective NGL costs per metric ton delivered to South Alaska

(1988 Nominal Dollars)
Total System

	Lower Tariff	Higher Tariff
Propane	224.81	312.25
Butane	259.05	359.76

Phase 1 System

	Lower Tariff	Higher Tariff
Propane	300.61	407.94
Butane	346.36	469.93

To establish marketability for LPG shipments, additional costs of shipping from South Alaska, receiving in Japan, and special handling must be compared with petroleum-based naptha costs, the competitive commodity.

Ethane, for the purpose of this study, has been assumed to be shipped as a component of LNG. It can be shipped separately as liqueified ethane gas (LEG). Alternatively, an ethylene plant might be located in South Alaska to make shipments of unprocessed ethylene into the growing Japanese market.

ETHYLENE CONSUMPTION BY JAPAN	
1980	9 billion pounds
1982	10 billion pounds
1990E	14 billion pounds

Alaska's ethylene production potential from the proposed TAGS project would be in excess of 2 billion pounds per year of ethylene as various derivatives. It is conceivable that with Japan's relatively high level of ethylene consumption the quantities produced from an Alaskan ethylene plant could be absorbed into present Japanese supplies. To do so, however, it must also be competitive with naptha based derivatives.

Mitsui and Company, in a November report to the Committee addressed the issue of naptha prices in Japan and LPG/LEG markets as follows:

"In order to come up with more accurate estimates of what prices would be competitive with imported naphtha at plant inlets, we would have to estimate the costs of handling LPG and LEG in Japan, taking into consideration the very numerous factors involved. However, we would like to point out that the importation of LPG for LPG would involve not only the handling costs but also the huge capital expenditures that would be required for the construction of LPG or LEG unloading facilities and storage tanks. A few petrochemical complexes in Japan have their own terminals for receiving LPG from ocean-going tankers, but there is no terminal for receiving LEG in Japan because LEG has never been exported to Japan.

"To summarize, we can state the following general conclusions:

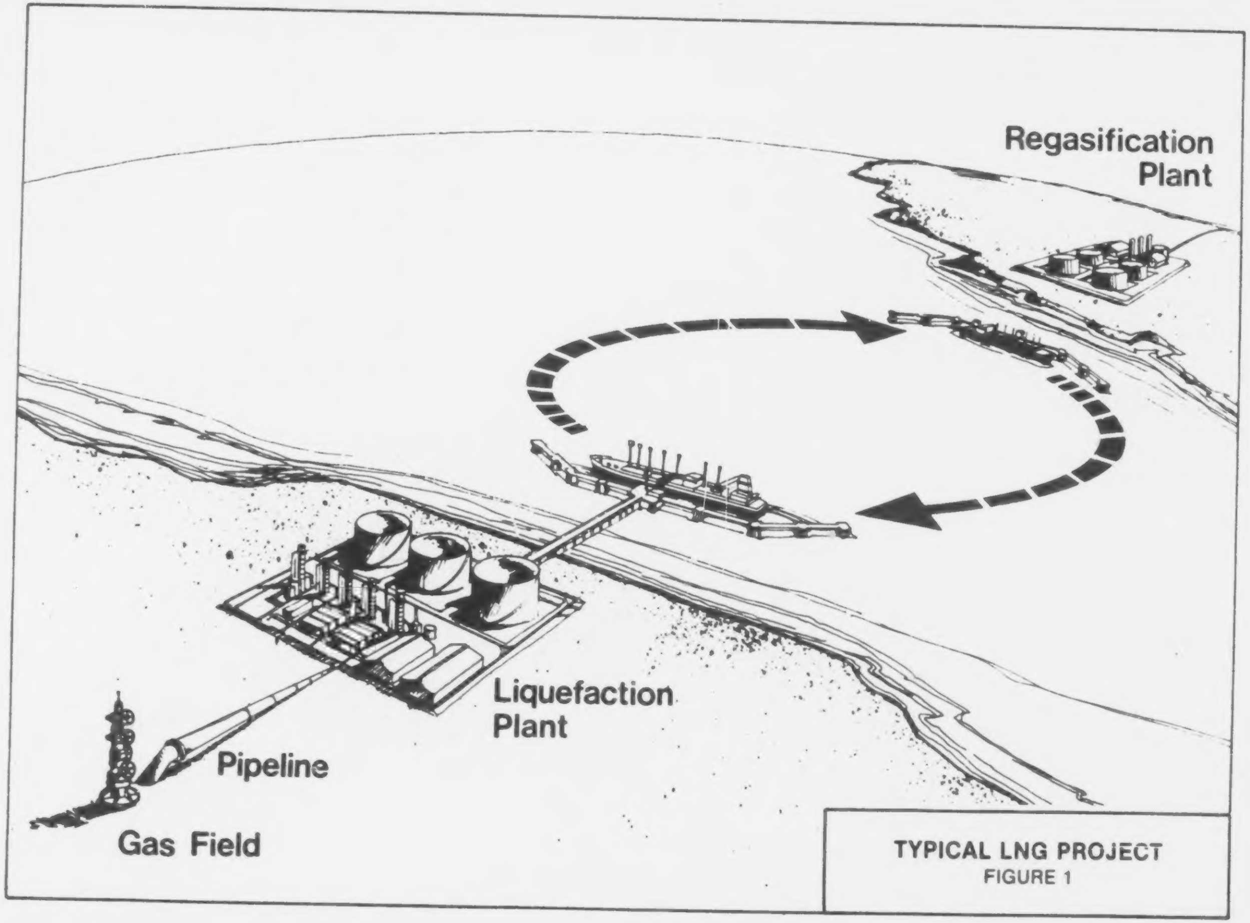
(1) "The future prices of petrochemical feedstocks in Japan will be determined by the prices of naphtha, and in turn, naphtha prices will be determined by world oil prices.

(2) "LPG could be exported to Japan as a competitively priced petrochemical feedstock, but LEG could not.

(3) "Ethane gas could be exported to Japan as a fuel (but not as a petrochemical feedstock) in the form of LEG, or it could be transformed into ethylene in Alaska, and Alaska could export ethylene to Japan as an intermediate raw material for petrochemical production."

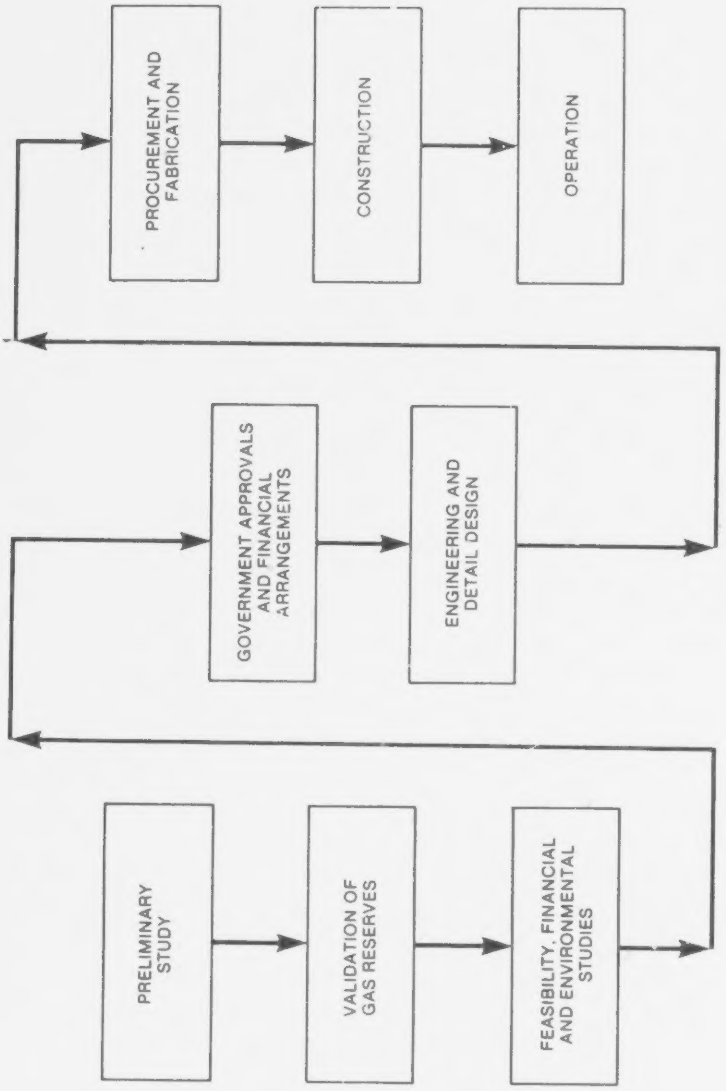
C. U.S. Market

While the current U.S. market for NGL's is over-supplied, it is important to note that U.S. domestic NGL production has declined since the mid 1970's. In light of decreasing domestic production the potential availability of such a large supply in a politically stable location may prove attractive to the petrochemical industry. This fact provides significant benefits to an Alaskan hydrocarbon development.



Regasification
Plant
Liquefaction
Plant
Pipeline
Gas Field

TYPICAL LNG PROJECT
FIGURE 1


PRELIMINARY STUDY
VALIDATION OF GAS RESERVES
FEASIBILITY, FINANCIAL AND ENVIRONMENTAL STUDIES
GOVERNMENT APPROVALS AND FINANCIAL ARRANGEMENTS
ENGINEERING AND DETAIL DESIGN
PROCUREMENT AND FABRICATION
CONSTRUCTION
OPERATION

TYPICAL LNG PROJECT DEVELOPMENT
FIGURE 2

VI. Shipping

A. Overview

In a typical international LNG project, natural gas is transported via pipeline from gas fields to a liquefaction plant at an ocean port location. Here it is refrigerated to about -260F, at which point it becomes a liquid and shrinks to about 1/600th of its gaseous volume. The liquefied gas is stored at atmospheric pressure in heavily insulated tanks located at the marine loading terminal until it is loaded into specially designed LNG vessels. The LNG vessels then transport the LNG to a marine receiving terminal, where it is heated, vaporized and delivered to a pipeline transportation system and ultimately to the consuming market. A typical LNG transportation system which does not include conditioning and separation of gas liquids, is illustrated in Figure 1.

Most base-load LNG projects, as opposed to peak-shaving LNG projects, have certain features in common regardless of the origin of supply and the market served. They are complex, involve large quantities of energy and equipment, and require multiple governmental approvals, large capital investments, and long lead times to implement (Figure 2). Furthermore, they usually have several participants and are generally international in nature. The resulting mix of these elements gives each project a unique character.

One of the distinguishing features of an LNG project is the large capital investment required for the project facilities. Costs vary greatly according to the particular project, but usually run into the billions of dollars. To deliver energy at an acceptable cost requires that the recovery of the investment be spread out over long periods of time, generally from 15 to 20 years. Protection of this capital investment demands project facilities that are reliable and which can continuously produce LNG throughout the life of the project.

The distance of the natural gas reserves from an acceptable market has a direct bearing on the delivered price of the gas. The more distant the gas source, the more shipping capacity that is required. This additional capacity can be provided in the form of larger vessels, more vessels and/or increased vessel speed, all of which directly affect the LNG shipping cost.

Since the volume of LNG to be transported and the distance between the loading and unloading terminals is fixed, the shipping capacity - in terms of vessel speed, size, and number - becomes the transportation system variable and is, therefore, the optimization focus for an LNG marine transportation system. These elements must also be brought into a balanced interface with the terminal and plant design variables.

B. Marine Loading and Unloading Terminal Characteristics

The marine loading and unloading terminals for an LNG transportation system are comprised of LNG storage and (un)loading facilities (LNG storage tanks and LNG cargo (un)loading lines) plus the offshore vessel berthing and access facilities.

The location of the marine loading and unloading terminal sites must satisfy requirements dictated by the design, construction, and operation of the LNG and regasification plants, the LNG marine terminal with attendant LNG storage and (un)loading facilities, as well as by the design and operational characteristics of the LNG vessels. The following general characteristics of a marine terminal have been followed by the industry in the construction of the existing three major U.S. receiving terminals plus the existing loading terminals in Indonesia, Algeria, and Abu Dhabi:

- The terminal sites should be as close as possible to the plants. A minimum water depth of maximum vessel draft plus five feet at mean lower low water (MLLW) is desirable. This water depth minimizes the impact on the environment so as to preclude the requirement of dredging.

- The marine terminal should be as close as possible to shore to minimize liquid line length and resulting LNG product losses, and to further minimize the cost of the access pier to the berths.

- Desirable characteristics for sea bottom soils should be granular soils or medium to soft clays. Because of the structural system normally used in the design of most terminals, it is desirable to have bedrock located at a reasonable depth below sea bottom.

- No active fault zones should be located on or adjacent to the marine terminal or plant site.

- To minimize ship downtime during loading and unloading operations, there should be a minimal occurrence of excessive wave heights and wind speeds. Studies and operating experience have indicated that LNG (un)loading operations may have to cease when wind and wave conditions become excessive.

- As a preliminary criterion, areas for vessel manuevering should provide a channel width of three times the width (beam) of the vessel when traffic is limited to one-way, and six times the width of the vessel when two-way traffic is expected. The minimum diameter of any turning basin, if needed, should be equal to 1-1/2 to 2 times the length of the vessel.

The required characteristics of navigable waterway approaches for LNG trades into newly designed ports and terminals are more stringent than for existing ports and new terminals. Where possible, it is desirable to align the terminal's approach with the following criteria:

- The size and depth of the approach channel should be the same as that at the berth, with a minimum channel width of three times the beam of the vessel for one-way traffic and six times the beam for two-way traffic.

- It would be desirable to have no sharp turns in the channel, and overhead structures should have a minimum air clearance consistent with local regulatory requirements.

- Vessel traffic patterns require minimal marine traffic interference and well defined marine traffic patterns. Traffic safety systems have become preferred by most areas where there is a large amount of marine traffic through a narrow waterway.

- Sufficient aids to navigation should be available in areas near the marine terminals in addition to the approach to the terminals.

- Anchorage areas should have moderate water depths, good shelter and ample manuevering room. To obtain good holding power, a ship generally lets out a length of chain equal to five to seven times the depth of the water. Most large vessels carry approximately 1000 feet of anchor chain.

C. LNG Marine Transportation System Parameters

1. Fleet Capacity

The transportation capacity of the fleet - number of vessels, vessel cargo capacity, and vessel service speed - is based on the project LNG transportation requirements (design material balance), trade route characteristics, and the project and LNG vessel design and operational parameters.

a. LNG Transportation Requirements

The LNG transportation requirements for the project are based on three levels of LNG production at the Nikishka plant which are brought on-stream in build-up phases with two year intervals between each phase. Further, the product may be shipped to four alternate unloading terminals located at: Osaka, Japan, Inchon, Korea, Pt. Conception, California and Bellingham, Washington.

The LNG quantities to be loaded and transported are as follows:

LNG produced -	Phase I	Phase II	Phase III
MMSCF/D	736.2	1,356.1	2,193
MMM BTU/D	783.3	1,442.9	2,333
M^3 Liquid/Yr	12,292,809	22,642,012	36,617,945

Operationally, the cargo tanks of the ship are filled at the Nikishka LNG Plant to approximately 97.5 percent of rated volumetric capacity. The tanks are emptied at the unloading terminal, except for a small fraction of the cargo, or heel, which is left on board to cool the cargo tanks during the return voyage to Alaska. The tanks are intermittently spray-cooled throughout the ballast voyage to a temperature of minus 220°F to assure the vessel is ready for immediate loading upon arrival at the Nikishka terminal.

During both the loaded and ballast voyages, a portion of the LNG boils off due to heat influx through the cargo tank insulation and into the ship's cargo tanks. This boil-off is used as boiler fuel en route.

b. Trade Route Characteristics

The trade routes for the Trans Alaska Gas System extends from a marine terminal and liquefaction facility located near Nikishka inside Cook Inlet to alternate marine terminals and vaporization plants which could be located at: 1) Osaka, Japan, 2) Inchon, Korea, 3) Bellingham, Washington, and 4) Point Conception, California. The one-way distances between the terminals are as follows:

	Osaka, Japan	Inchon, Korea	Pt. Conception, CA	Bellingham, WA
FROM Nikishka LNG Loading Terminal	3600*	4040*	2100*	1400*

*Nautical Miles

Fleet operations en route are affected by weather, sea conditions, visibility, navigational restrictions and regulations, as well as vessel traffic density. Specific en route wind and current conditions for winter and summer are not available for this report. Also, the specific operational considerations for the five ports are not available for this report.

2. LNG Vessel Design and Operating Assumptions

The following assumptions regarding the vessels and their operation will be the basis for this study which determines the preliminary configuration of the fleet:

- Essentially, all LNG vessels are mechanically and geometrically similar, i.e., steam turbines, single shaft, approximately 40,000SHP, etc.

- All LNG vessels comprising the fleet are generally similar in terms of cargo capacity (126,600 m^3 average), service speed (18.5 knots), and operating characteristics.

- Each LNG vessel will be loaded to 97.5% of its capacity (123,500 m^3).

- The assumed LNG cargo daily boiloff rate of 0.15 percent of the LNG cargo loaded.

- Each LNG vessel is in operating service an average of 329.7 days annually. The remaining days are utilized for planned maintenance and for random repairs and delay (Table 1).

- Loading and unloading operations are conducted in the respective terminals 24 hours a day without allowing for nighttime restrictions on LNG vessel movement.

- Sufficient drydock space and related maintenance facilities are available upon demand within reasonable distance of the trade route to service the fleet within the specified times.

TABLE 1 - SHIP UTILIZATION

			DAYS PER YEAR
ASSUMED OPERATING YEAR			365
LESS: Ship out-of service time			
Drydock schedule[a]			
Drydock time	14.0		
Cooldown[b]	2.3		
Diversion en route[c]	4.0		
Total drydock time		20.3	
Random repair and delay		15.0	
Total ship-out-of-service time			35.3
ANNUAL SHIP UTILIZATION			329.7

[a] Each vessel is drydocked either on the west coast of the United States or in a foreign shipyard in either Japan or Korea.

[b] The total time of 2.3 days (54 hours) is divided into two categories:

1) Purging of inert gas (24 hours)
2) Cooldown (30 hours)

[c] Diversion en route is the difference in the following:

Voyage time from the loading terminal to drydock to the Nikishka LNG Plant less normal ballast voyage time.

- The LNG fleet exclusively serves the Trans Alaska Gas System Project.

- Even though an existing LNG trade operates at the Osaka terminal this project does not share the marine facilities at the four assumed unloading terminals with other LNG projects.

Additional operating assumptions for the fleet with respect to the trade route and the loading and unloading terminals are as follows:

- The distance between the ports as shown in Table 2 considers the total distance the vessels must travel, most of which time they will operate at their service speeds. An adjustment must also be made to the voyage time for the distance each vessel must travel to and from the terminals at reduced speeds.
- The port event times shown in Table 3 are the average expected times required for a vessel to complete each activity in each of the ports and terminals. The times required for pilot pick-up, bay ingress/egress, tie-up, and cast-off are the same for all LNG vessels, regardless of capacity. The time required to load and discharge LNG cargo is the same for each vessel.

Table 2 - Trade Route Distances
(Nautical Miles)

Nikishka To:[a]	Osaka, Japan	Inchon, Korea	Bellingham, Washington	Pt. Conception, CA
One-way distance	3,600	4,040	1,400	2,100
Distance from Nikishka to Mouth of Cook Inlet	50	50	50	50
Distance from Port Entrance to Unloading Marine Terminal	100	10	150	10

[a] Source: Distance Between Ports, 1976 which provides mileages from junction points and ports

Table 3 - Estimated Average Event Times For Port Operations

POINT CONCEPTION AND BELLINGHAM	
Tie-up	.28
Unload	.50
Cast-off	.22
Delays	.67
Total Port Time	1.67 Days/Trip

INCHON	
Tie-Up	.26
Unload	.50
Cast-off	.23
Delays	.64
Total Port Time	1.63 Days/Trip

OSAKA	
Tie-up	.26
Unload	.50
Cast-off	.23
Delays	.65
TOTAL Port Time	1.63 Days/Trip

NIKISHKA	
Tie-Up	.27
Load	.50
Cast-off	.23
Delays	.95
TOTAL Port Time	1.95 Days/Trip

3. LNG Plant Operating Assumptions
   Annual maintenance for the LNG plant should begin approximately at the same time the first LNG carrier enters annual drydocking.

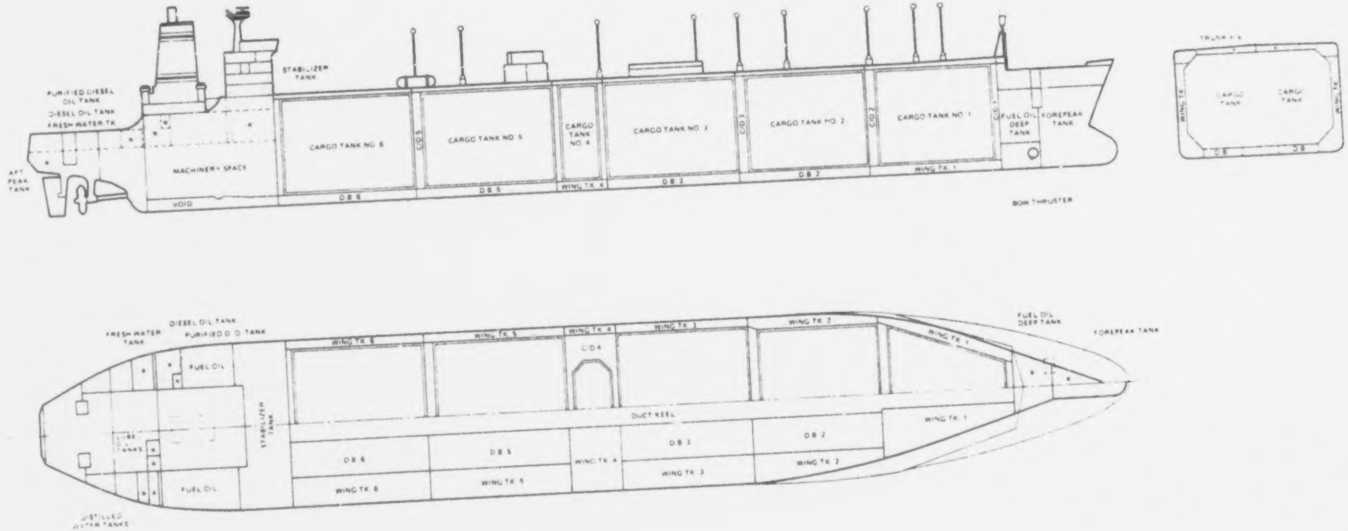
4. Loading and Unloading Terminal Design and Operating Assumptions
   The vaporization capacity of each unloading terminal is assumed to be such that the LNG carriers will not be delayed due to insufficient unloading and storage capacities.

   It is assumed that the terminal capacities of each location are as follows:

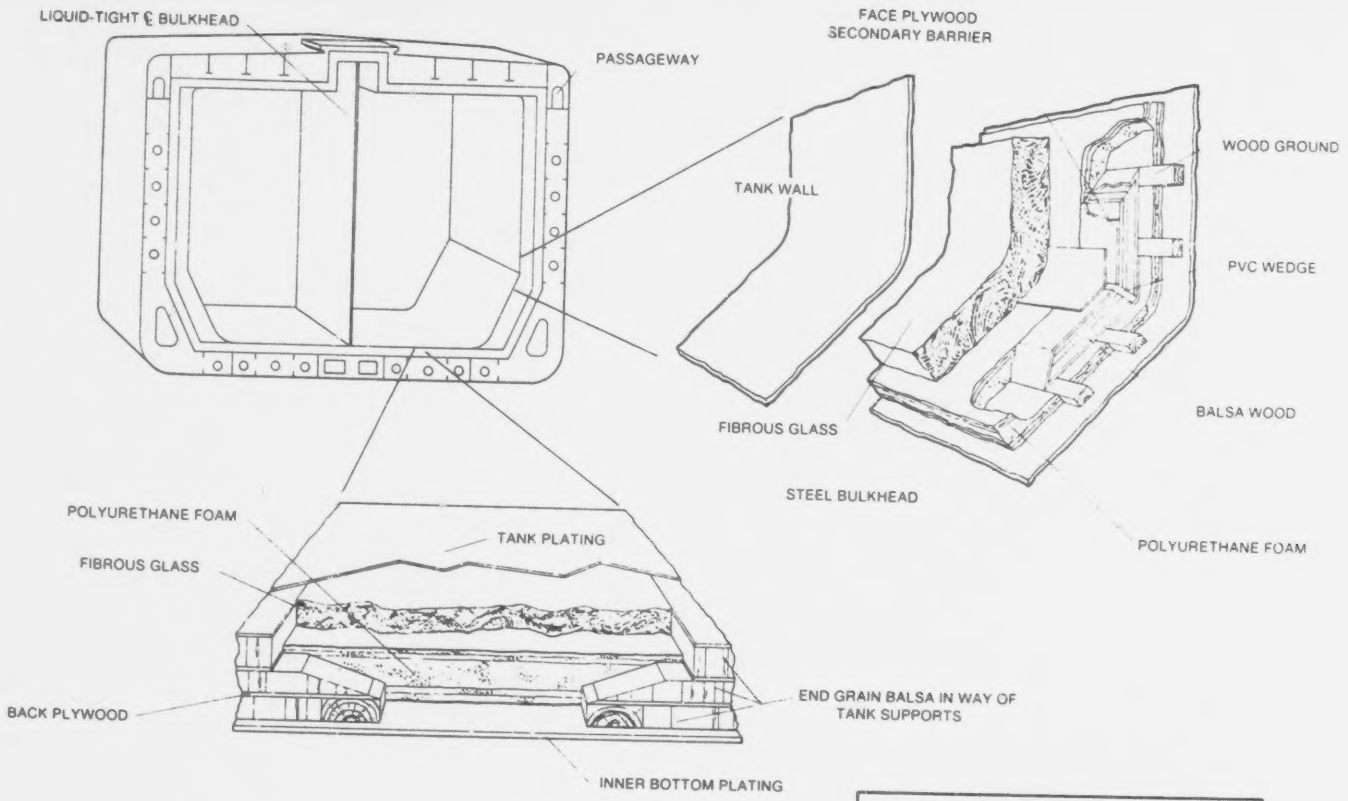
	Nikishka	Pt Conception	Bellingham	Inchon	Osaka
Number of Berths	2	2	2	2	2
Number of cryogenic liquid lines between terminal and LNG storage tanks	2	1	1	1	1
Loading and unloading rates m^3/hr	11,500	12,000	12,000	12,000	12,000
LNG storage capacity $m^3 \times 10^3$	300	300	300	300	300

This report does not consider the production, storage, and marine transportation of natural gas liquids and LPGs.

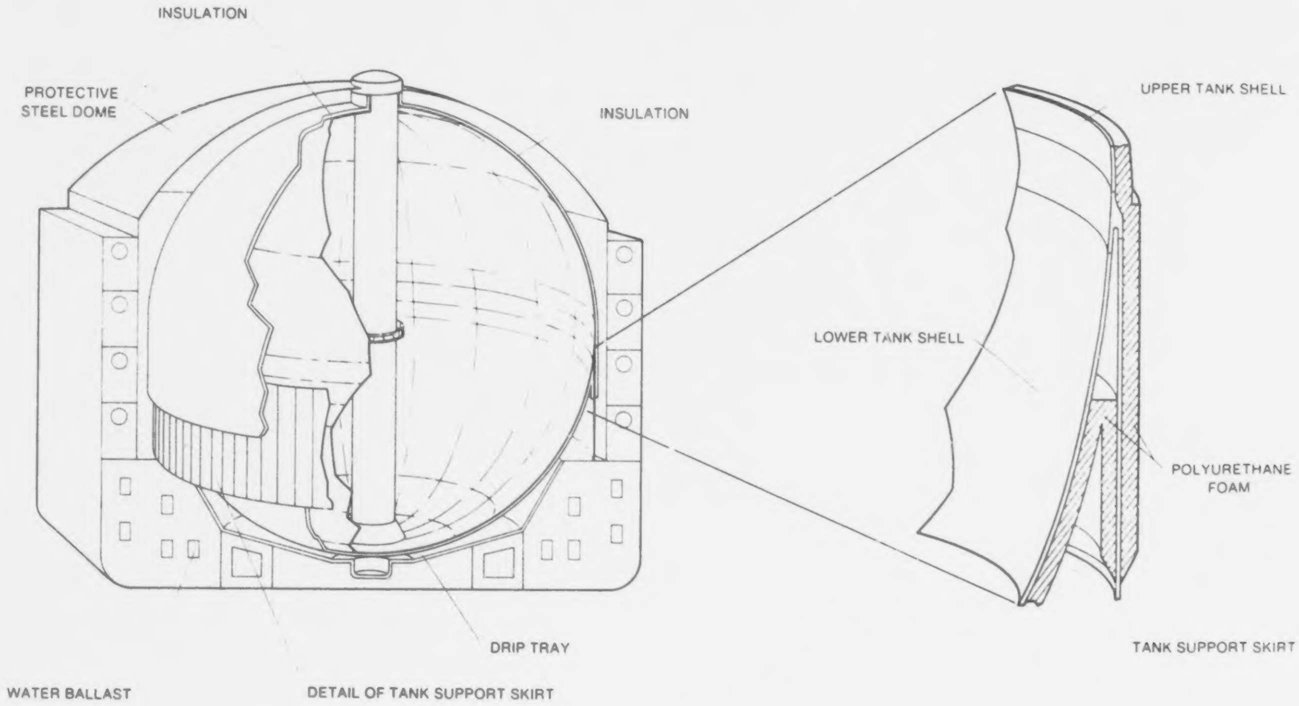
D. Project Marine Transportation Requirements
   An optimized configuration of fleet, plant, and terminal capacities for any project generally results after completing a rigorous analysis of all reasonable alternative design combinations. Likewise, the Trans Alaska Gas System project will require a rather comprehensive engineering effort before a viable overall plan is submitted for final approval.


PURIFIED DIESEL OIL TANK
DIESEL OIL TANK
FRESH WATER TK
AFT PEAK TANK
STABILIZER TANK
MACHINERY SPACE
VOID
CARGO TANK NO. 6
C/D 5
CARGO TANK NO. 5
CARGO TANK NO. 4
CARGO TANK NO. 3
C/D 3
CARGO TANK NO. 2
C/D 2
CARGO TANK NO. 1
C/D 1
FUEL OIL DEEP TANK
FOREPEAK TANK
DB 6
DB 5
WING TK 4
DB 3
DB 2
WING TK 1
BOW THRUSTER
CARGO TANK
CARGO TANK
WING TK
DB
FRESH WATER TANK
DIESEL OIL TANK
PURIFIED D.O. TANK
FUEL OIL
LUBE OIL TANKS
DISTILLED WATER TANKS
STABILIZER TANK
WING TK 6
WING TK 5
WING TK 4
WING TK 3
WING TK 2
WING TK 1
C/D 4
DUCT KEEL
DB 6
DB 5
DB 3
DB 2
FUEL OIL DEEP TANK
FOREPEAK TANK

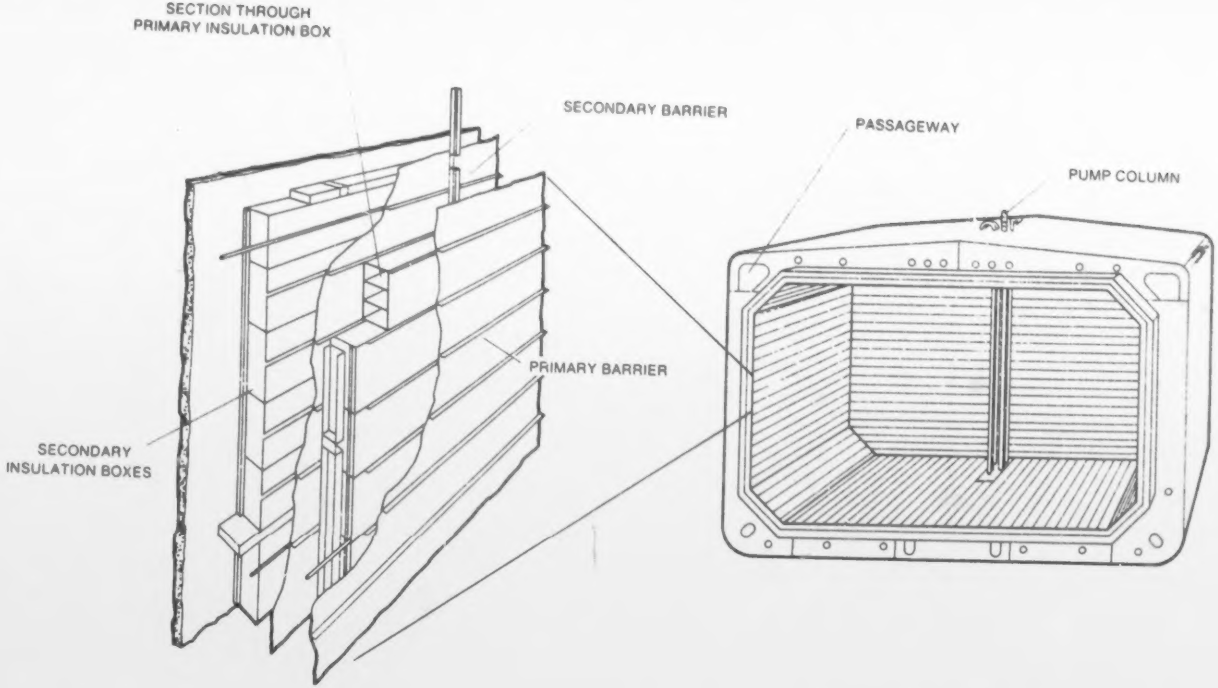
GENERAL ARRANGEMENT
OF TYPICAL LNG CARRIER
FIGURE 3


LIQUID-TIGHT ℄ BULKHEAD
PASSAGEWAY
FACE PLYWOOD
SECONDARY BARRIER
TANK WALL
WOOD GROUND
PVC WEDGE
BALSA WOOD
FIBROUS GLASS
STEEL BULKHEAD
POLYURETHANE FOAM
POLYURETHANE FOAM
TANK PLATING
FIBROUS GLASS
BACK PLYWOOD
END GRAIN BALSA IN WAY OF
TANK SUPPORTS
INNER BOTTOM PLATING

**CONCH FREESTANDING
TANK DESIGN**
FIGURE 4

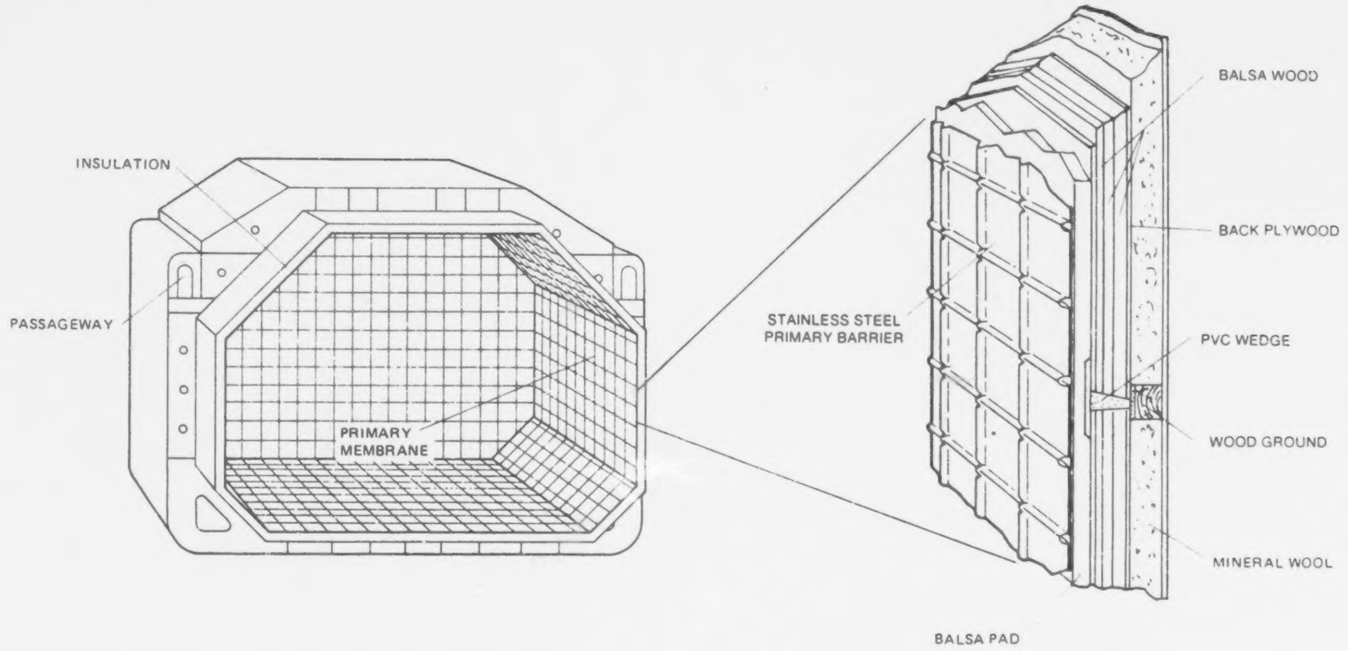

INSULATION
PROTECTIVE STEEL DOME
INSULATION
UPPER TANK SHELL
LOWER TANK SHELL
POLYURETHANE FOAM
DRIP TRAY
TANK SUPPORT SKIRT
WATER BALLAST
DETAIL OF TANK SUPPORT SKIRT

KVAERNER - MOSS SPHERICAL TANK DESIGN
FIGURE 5


SECTION THROUGH
PRIMARY INSULATION BOX
SECONDARY BARRIER
PASSAGEWAY
PUMP COLUMN
PRIMARY BARRIER
SECONDARY
INSULATION BOXES

GAZ TRANSPORT MEMBRANE TANK DESIGN

FIGURE 6


INSULATION
PASSAGEWAY
PRIMARY MEMBRANE
STAINLESS STEEL PRIMARY BARRIER
BALSA WOOD
BACK PLYWOOD
PVC WEDGE
WOOD GROUND
MINERAL WOOL
BALSA PAD

TECHNIGAS MEMBRANE TANK DESIGN
FIGURE 7

The present study, however, employs existing technology and the use of the existing supply of LNG vessels with cargo capacities in the range of 120,000 - 130,000 m^3 and having an average cargo capacity of 126,000 m^3. Further, the assumed fleet has been sized to have sufficient capacity to lift and transport approximately 104% of the annual quantity of LNG produced at the Nikishka plant. This nominal fleet overcapacity is available to accommodate the various design and operational uncertainties related to project.

If, for example, all of the LNG produced is Nikishka were shipped to Japan, the fleet requirements would range from 6 to 17 vessels.

E. LNG Vessels - Design and Availability

The state of the art for marine transportation of LNG has advanced considerably in the past 15 years. Ships with a design capacity of 125,000 to 130,000 cubic meters are now in operation and designs have been considered for ships with cargo capacities in excess of 180,000 cubic meters. A general arrangement for a typical 125,000 m^3 LNG carrier is shown in Figure 3.

1. Cargo Containment System Design

There are two basic types of LNG containment system designs employed in LNG transportation: the self-supporting and membrane types. The self-supporting design employs cargo tanks which are either spherical or prismatic, constructed with the tank walls capable of supporting themselves and the weight of the LNG cargo. The cargo containment systems of the membrane designs are constructed from thin-walled, metal alloy membranes with the load of the cargo tanks and its LNG cargo supported by the tank insulations and ship structure.

There are at least seven different self-supporting systems and five membrane systems currently in use or offered for license. The self-supporting systems include Conch Methane (Figure 4) Gaz Transport, Esso International, Kverner-Moss (Figure 5), A. G. Weser, and Zellentank.

The membrane systems include Gaz Transport (Figure 6), Gazocean-Technigas (Figure 7), Conch Ocean, McMullen, and Bridgestone.

Although no one design has established a position as the outstanding favorite, the Japanese LNG importers have expressed a preference for the Kverner-Moss design. Alternately, most of the vessels operated by the Algerians are constructed with the Gaz Transport design. There are also several vessels with the Technigas design that have operated successfully for several years.

Historically, the first LNG tanker, "Methane Pioneer", used the Conch system, as did the "Methane Princess" and "Methane Progress". These ships have been sailing between Algeria and the United Kingdom since 1964.

The Gaz Transport or Wormes design is a double-wall containment system using thin sheets of Invar (36% nickel steel). This is the design used in: 1) the two ships which are trading between Alaska and Tokyo, 2) one of the ships trading between Skikda, Algeria and southern France, and 3) the three El Paso vessels built by the France-Dunkerque shipyard which traded between Algeria and the U.S.

The other membrane design used in commercial operation is the Technigas or Gazocean design (Figure 7) which uses the waffle membrane to accommodate thermal expansion and contractions. This design has been used in the "Descartes", the "Mostefa Ben Boulaid", and the "Ben Franklin". Also, this system is in the three El Paso vessels, built at the Newport News shipyard, which also traded between Algeria and the U.S.

2. LNG Vessel Availability

As a result of the slowdown in worldwide LNG activity, the number of laid-up LNG vessels has risen over the last two years and the ensuing disequilibrium between supply and demand for the LNG vessels remains unchecked. As the following data indicates, slightly greater percentage of the larger and more recently constructed vessels are idle in comparison to those built during the early years of the LNG industry development.

VESSELS OPERATING OR LAID UP AUGUST 31, 1982

Ship Size (1,000 M^3)

	20-35	40-50	70-75	87.6	120-130	TOTAL
Operating	4	4	9	2	16	35
Laid Up	3	3	0	0	17	23
TOTAL	7	7	9	2	33	58

The 17 vessels of 120-130,000 M^3 capacity that are presently laid up include the six vessels that were dedicted to the Algerian-El Paso project but excludes the five ships now operating in the Algerian-Trunkline LNG trade. The data does not include the three vessels built by Avondale Shipyards for El Paso which have been removed from consideration for LNG service.

Table 5 profiles the current situation regarding the world wide fleet of LNG vessels. It should be noted that the only vessels presently idled pending resolution of the Algerian price dispute are the six (6) El Paso vessels (Numbers 14-19 Table 5, page 4).

Other LNG vessels that have yet to be delivered or that are on order (Table 5, page 3) include seven vessels of 130,000 M^3 for the Indonesian-Japanese trade and one ship due to be delivered later this year for the Sarawak project. All of these vessels are expected to be placed under a long-term charter for projects that are encountering no difficulty in development and, as such may be laid up for only short periods of time.

3. El Paso LNG Vessels

Subsidiaries of the El Paso Company entered into long term contracts in 1969 and the early 1970s for the purchase and sale of Algerian LNG to the U.S. These contracts contemplated the construction and the operation of 9-125,000 cubic meter LNG vessels. These vessels were to be owned by subsidiaries of the El Paso Company, and were to be used to deliver LNG to Cove Point, Maryland and Elba Island, Georgia.

Six of the nine vessels were constructed and placed into the project's service. Construction of three of the vessels (those built by Avondale Shipyards) was never completed, and these vessels are no longer considered fit for LNG service. Three of the six El Paso vessels that actually operated were constructed by Newport News Shipbuilding and Dry Dock Company, were registered in Wilmington, Delaware under the U.S. flag and financed under MarAd Title XI guarantees. These three vessels are:

	Delivered	Entry Into Service	Status
El Paso SOUTHERN	05/31/78	10/18/78	Lay-Up (US)
El Paso ARZEW	12/08/78	01/15/79	Lay-up (US)
El Paso HOWARD BOYD	06/29/79	07/17/79	Lay-up (US)

The other three El Paso vessels were constructed by Ch. de France-Dunkerque, were registered in Monrovia, Liberia under the Liberian flag and financed through two French banks under typical OCED terms. These three vessels are:

	Delivered	Entry Into Service	Status
El Paso PAUL KAYSER	05/25/75	09/15/78	Lay-Up (US)
El Paso SONATRACH	10/12/76	03/01/78	Lay-up (Norway)
El Paso CONSOLIDATED	06/08/77	05/29/78	Lay-up (US)

It may be possible that the three NNS vessels could qualify for trades between two US ports. However, the three FD vessels could qualify only by receiving a special Jones Act waiver.

Currently, these six vessels are for sale by El Paso. Long term charter arrangements may be possible with El Paso as well.

F. LNG Safety

Design requirements for gas ships, as codified by the U.S. Coast Guard and IMCO, are far stricter than those for oil tankers. For instance, typical gas carrying vessels are constructed with double bottoms and double hulls to minimize the impact on cargo banks in the event of collision, grounding or stranding. Cargo tanks must be located at specified minimum distances inboard from the ship's outer hulls.

The cargo tanks are never opened when transfering cargo. During LNG vessel loading and discharge operations, the LNG vapor is either taken from the ship or returned to the ship from the LNG storage tanks on shore to replace the volume of liquid that is discharged to maintain a closed system at all times. These built-in safeguards are instrumental in preventing serious consequences of accidents to LNG vessels.

G. Economics

The cost of shipping LNG is a function of the capital investment in the LNG vessels and shorebased facilities plus the related annual operating expenses. The capital charge (depreciation, interest expense, profit, and taxes on income) component of a freight rate will depend on the capital costs of both the LNG vessel and the required shorebased facilities; the specific financing arrangements (capitalization, debt term and interest rate), the rate of return desired by the project participants and the income tax laws which apply to the owners of the ships and the owners of the shorebased facilities.

The annual operating expenses for the LNG vessels will vary with the complement and nationality of the ships' crews, the trade route (as it affects vessel insurances) and the cost of marine fuel oil. These three items can easily comprise over 65% of an LNG vessel's annual operating expenses.

Annual operating expenses for the shorebased facilities will depend on the type of facilities needed to support the LNG fleet and the personnel and overhead required to maintain efficient operations.

1. Capital costs and Freight Rates - Vessels

   As stated (Table 5), approximately seventeen LNG vessels, ranging in size from 120,000 to 130,000 cubic meters, are currently in a laid-up status and, hence available to the project. A definitive statement regarding whether these vessels are available for purchase or whether their owners would prefer to charter them into the project on a long-term basis is beyond the scope of this report. Suffice it to say, however, that the cost to the project would be considerably less if any one of the available vessels were to be obtained for the project as opposed to acquiring a newly-constructed vessel of the same capacity.

   a. The El Paso LNG Vessels

      The average cost to purchase the three El Paso vessels which were constructed by Newport News Shipbuilding and Dry Dock Company is estimated to be $57.6 million each or $172.8 million for all three. With annual operating expenses estimated at $13.7 million and capital charges estimated at $11.5, the cost of transporting LNG in one of these vessels would be as follows:

Unloading Terminal	Approximate Freight Rates in U. S. Cents Per Million BTU Delivered
Osaka, Japan	58.1
Inchon, South Korea	67.9
Ft. Conception, California	38.3
Bellingham, Washington	31.3

If the three vessels constructed by Chantiers de France Dunkerque (CFD) for El Paso were purchased for the project for a total estimated cost of $35 million, then, given the same return to capital and similar operating expenses as shown for the NNS vessels, the approximate cost of transport LNG in one of the CFD vessels would be as follows:

Unloading Terminal	Approximate Freight Rates in U. S. Cents Per Million BTU Delivered
Osaka, Japan	37.1
Inchon, South Korea	43.4
Ft. Conception, California	24.5
Bellingham, Washington	20.0

b. New Vessels

The cost of newly-constructed LNG vessels can vary greatly depending primarily on the country of construction and the health of the world-wide ship building industry. Currently, the cost would probably fall within the range of $150-200 million. LNG vessels costing in this range and having the same return to capital and operating expenses as the El Paso ships would require freight rates as follows:

Unloading Terminal	Approximate Freight Rates in U. S. Cents Per Million BTU Delivered
Osaka, Japan	100.7 - 123.7
Inchon, South Korea	117.8 - 144.7
Pt. Conception, California	66.4 - 81.6
Bellingham, Washington	54.3 - 66.7

As reflected in Section D, Phase III deliveries would require a maximum of 19 ships if all the LNG were delivered to Inchon, Korea, and a minimum of 9 if all deliveries were made to Bellingham, Washington. If it is assumed that 50 percent of the LNG would be delivered to the west coast of the United States and the remainder to Japan and Korea, the project would require approximately 14 ships. Further, assuming that all six of the El Paso vessels were brought into the project and newly-constructed LNG vessels made up the difference, the approximate, average freight rates which would be required are as follows:

Delivery Area	Approximate Average Freight Rates in U.S. Cents Per Million BTU Delivered
Far East	84.4 - 98.7
U.S. West Coast	46.7 - 54.6

c. Use of Chartered Ships

An alternative to purchasing newly-constructed LNG vessels is obtaining existing ships through a chartering arrangement. Most charter agreements are based on a rate, expressed in dollars per cubic meter of LNG loaded, plus the actual costs for certain operating expenses, such as port charges and marine fuel. Variations in the rate and the operating expense items handled separately result from negotiations between the parties to the agreement.

It is reasonable to assume that the bottom line delivered cost for an LNG vessel chartered today would be about $15 per cubic meter loaded (including all capital charges and operating expenses) which would equate to a delivered rate per million BTU of about 66.4¢ to the Far East and 65.8¢ to the U.S. west coast. In short, the use of chartered ships which are currently in a laid-up status would tend to lower the average freight rates shown for deliveries to the Far East, but increase them slightly for deliveries to the U.S. west coast.

2. Capital Costs and Operating Expenses - Shorebased Facilities

Shorebased facilities are required, separate from the marine terminal, to service the LNG vessel fleet and to administer the ocean shipping segment of the project. The exact requirements cannot be estimated until the LNG vessel fleet size and the delivery points are known. However, it is estimated that the increment to the freight rates necessary to cover the cost of these facilities will not be more than 5¢ per million BTU delivered.

3. Fleet Summary

The overall marine transportation economics is based on three assumed combinations of LNG vessels. The first fleet (Fleet 1) consisted of all newly-constructed ships, the second fleet (Fleet 2) consisted of all chartered ships which are currently in existence, and the third fleet (Fleet 3) consisted of using six El Paso vessels first, with the balance of the fleet requirements made up by chartering currently existing ships. The estimated freight rates, excluding the increment for shorebased facilities, port charges and unloading terminal facilities, for each fleet to deliver all the LNG to each unloading terminal during each phase of the build-up period is shown as follows:

(Stated in U.S. Cents Per Million BTU Delivered)

Destination	Phase I	Phase II	Phase III
Osaka, Japan 1)			
Fleet 1	112.2	112.2	111.4
Fleet 2	65.7	66.2	66.1
Fleet 3	47.6	54.2	58.5

Destination	Phase I	Phase II	Phase III
Inchon, South Korea 1)			
Fleet 1	131.3	123.3	124.8
Fleet 2	65.9	66.3	66.3
Fleet 3	49.5	57.4	60.6
Pt. Conception, California 1)			
Fleet 1	74.0	71.0	71.3
Fleet 2	65.0	65.4	65.4
Fleet 3	27.,9	33.5	45.0
Beilingham, Washington 1)			
Fleet 1	55.2	60.5	58.0
Fleet 2	64.7	65.1	65.1
Fleet 3	18.3	25.7	33.8

1) Assumes average cost of $175 million per ship

The increment to the freight rates for the fleet shorebased facilities and the port charges at both the loading and unloading terminals would be essentially the same for the three levels of LNG production. These costs, excluding unloading terminal costs, are as follows:

	Approximate Increment to Each Freight Rate in Cents Per Million BTU Delivered		
Unloading Terminal	Shorebased Facilities	Port Charges	Total Increment
Far East	5.0	1.5	6.5
U.S. West Coast	5.0	1.0	6.0

The range for the estimated capital requirements and annual expenses during each phase of the build-up is shown on the following High and Low cases. The Low case represents the costs for the fleet required to deliver 100% of the LNG produced at Nikishka to Bellingham, Washington. Alternately, the high case represents the costs for the fleet required to deliver 100% of the LNG produced at Nikisha to Inchon, Korea. As previously stated, these costs exclude the estimates for the capital requirements and associated operating expenses for the fleet shorebased facilities and annual port charge expense.

ESTIMATED CAPITAL REQUIREMENTS AND ANNUAL EXPENSE

(Stated in Millions of Dollars)

	LOW			HIGH		
Description	I	II	III	I	II	III
Fleet 1						
Capital Requirements	$525	$1,050	$1,575	$1,225	$2,100	$3,325
Vessel Expenses	41.1	82.2	123.3	95.9	164.4	260.3
Fleet 2						
Charter Expenses	171.1	314.3	491.8	171.1	314.3	491.8
Fleet 3						
Capital Requirements	35.0	207.8	207.8	35.0	207.8	207.8
Annual Expenses:						
Vessel Expenses	41.1	82.2	82.2	82.2	82.2	82.2
Charter Expenses	-	-	131.5	4.7	147.9	325.4
TOTAL Annual Expense	41.1	82.2	213.7	86.9	230.1	407.6

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1)Based on average purchase cost of $175 million per vessel.

TABLE 5

LNG Carrier Review — January 1, 1982

	OWNER	SHIP	SPEED (KNOTS)	SIZE(m^3)	DESIGN	DELIVERY	SERVICE	BUILDER
IN SERVICE								
1.	Conch Methane Tankers Ltd	Methane Princess	17.25	27,400	Conch	1964	Laid-up	Vickers Armstrong (UK)
2.	Methane Tanker Finance Ltd	Methane Progress	17.25	27,400	Conch	1964	Laid-up	Harland & Wolff (UK)
3.	GAZ Marine	Jules Verne	17.00	25,500	Gaz Transport	1965	Algeria-France	Ateliers et Chantiers de la Seine (France)
4.	Naviera de Productos Licuados SA	Laieta	18.00	40,000	Esso	1970	Libya-Spain	Astilleros y Talleres del Noroeste (Spain)
5.	Prora Trasporti	Esso Brega	18.00	41,000	Esso	1969	Laid-up	Italcantieri (Italy)
6.	Prora Trasporti	Esso Porto Venere	18.00	41,000	Esso	1969	Laid-up	Italcantieri (Italy)
7.	Prora Trasporti	Esso Ligure	18.00	41,000	Esso	1970	Laid-up	Italcantieri (Italy)
8.	Arctic LNG Transportation	Arctic Tokyo	18.25	71,500	Gaz Transport	1969	Alaska-Japan	Kockums Mekanieska Verkstad (Sweden)
9.	Polar LNG Transportation	Polar Alaska	18.25	71,500	Gaz Transport	1969	Alaska-Japan	Kockums Mekanieska Verkstad (Sweden)
10.	Gazocean Armement	Descartes	17.00	50,000	Technigaz	1971	Algeria-France	Chantiers de L'Atlantique (France)
11.	Cie Nationale Algerienne de Navigation	Hassi R'Mel	17.50	40,000	Gaz Transport	1971	Algeria-France	CNIM (France)
12.	Shell International Marine	Gadinia	18.00	75,056	Technigaz	1972	Brunei-Japan	Chantiers de L'Atlantique (France)
13.	Shell International Marine	Gadila	18.00	75,079	Technigaz	1973	Brunei-Japan	Chantiers de L'Atlantique (France)
14.	Methane Carriers Ltd	Norman Lady	19.50	87,500	Moss	1973	Abu Dhabi-Japan	Moss Rosenberg Verft (Norway)
15.	Shell Tankers (UK)	Gari	18.00	75,072	Technigaz	12/73	Brunei-Japan	Chantiers de L'Atlantique (France)
16.	Smedvig Tankrederi	Venator	18.50	29,388	Moss	12/73	Floating Storage Das Island	Moss Rosenberg Verft (Norway)
17.	Messigaz	Tellier	17.50	40,000	Technigaz	1/74	Algeria-France	Chantiers Navals de la Ciotat (France)
18.	Shell Tankers (UK)	Gastrana	18.00	75,041	Technigaz	8/74	Brunei-Japan	Chantiers de L'Atlantique (France)
19.	LNG Carriers Ltd	Pollenger	19.00	87,600	Moss	10/74	Spot	Moss Rosenberg Verft (Norway)
20.	Kvaerner Group	Century (ex Lucian)	19.70	29,000	Moss	12/74	Algeria-Spain	Moss Rosenberg Verft (Norway)
21.	Middelburg Shipping Corp	Isabella (ex Kenai Multina)	20.00	35,000	Gaz Transport	4/75	Algeria-Spain	CNIM (France)
22.	Shell Tankers (UK)	Geomitra	18.00	77,731	Gaz Transport	3/75	Brunei-Japan	CNIM (France)
23.	CNIM (France)	Montana	20.00	35,000	Gaz Transport	4/75	for sale by yard	CNIM (France)
24.	Shell Tankers (UK)	Gouldia	18.00	75,001	Technigaz	6/75	Brunei-Japan	Chantiers Navals de la Ciotat (France)
25.	Gazocean Armement	Ben Franklin	19.00	120,131	Technigaz	6/75	Spot (LPG or LNG)	Chantiers Navals de la Ciotat (France)
26.	El Paso Marine Co	El Paso Paul Kayser	20.00	120,009	Gaz Transport	7/75	Laid-up	Chantiers de France Dunkerque (France)
27.	Shell Tankers (UK)	Genota	18.00	77,679	Gaz Transport	10/75	Brunei-Japan	CNIM (France)
28.	Gotaas-Larsen	Hilli	19.50	126,227	Moss	12/75	Abu Dhabi-Japan	Moss Rosenberg Verft (Norway)
29.	El Paso Marine	El Paso Sonatrach	20.00	126,165	Gaz Transport	9/76	Laid-up	Chantiers de France Dunkerque (France)
30.	Gotaas-Larsen	Gimi	19.50	126,277	Moss	12/76	Abu Dhabi-Japan	Moss Rosenberg Verft (Norway)
31.	Cie Nationale Algerienne de Navigation	Mostefa Ben-Boulaid	19.00	125,000	Technigaz	6/76	Idle Modifications by yard till 3/82	Chantiers Navals de la Ciotat (France)
32.	Zodiac Shipping Co	Gastor	19.3	122,255	Gaz Transport	8/77	Then laid up pending Indonesia-Los Angeles	Chantiers de L'Atlantique (France)

TABLE 5 - continued

LNG Carrier Review — January 1, 1982

	OWNER	SHIP	SPEED (KNOTS)	SIZE(m^3)	DESIGN	DELIVERY	SERVICE	BUILDER
IN SERVICE								
33.	Cryogenic Shipping Corp (Gotaas-Larsen)	Golar Freeze	20.00	125,858	Moss	3/77	Abu Dhabi-Japan	Howaldtswerke-Deutsche Werft (Germany)
34.	Gotaas-Larsen	Khannur	19.50	126,360	Moss	7/77	Abu Dhabi-Japan	Moss Rosenberg Verft (Norway)
35.	El Paso Marine Co	El Paso Consolidated	20.00	124,989	Gaz Transport	6/77	Laid-up	Chantiers de France Dunkerque (France)
36.	Cie Nationale Algerienne de Navigation	Larbi Ben M'Hidi	20.00	129,500	Gaz Transport	6/77	Algeria-USA	CNIM (France)
37.	Cryogenics Energy Transport Inc	LNG Aquarius	20.40	125,000	Moss	6/77	Indonesia-Japan	General Dynamics (USA)
38.	Odyssey Trading Co	Nestor	19.30	122,255	Gaz Transport	10/77	Laid-up pending Indonesia-Los Angeles	Chantiers de L'Atlantique (France)
39.	LNG Transport Inc	LNG Aries	20.40	126,312	Moss	12/77	Indonesia-Japan	General Dynamics (USA)
40.	Leif Hoegh	Hoegh Gandria	21.00	125,000	Moss	2/78	Abu Dhabi-Japan	Howaldtswerke Deutache Werft (Germany)
41.	Louis Dreyfus	Edouard L.D.	20.00	129,500	Gaz Transport	12/77	Laid-up	Chantiers de France Dunkerque (France)
42.	El Paso Southern Co	El Paso Southern	20.00	126,898	Technigaz	5/78	Laid-up	Newport News Shipbuilding (USA)
43.	Liquegas Transport	LNG Capricorn	19.00	126,326	Moss	6/78	Indonesia-Japan	General Dynamics
44.	El Paso Arzew Tanker Co	El Paso Arzew	20.00	126,929	Technigaz	11/78	Laid-up	Newport News Shipbuilding (USA)
45.	Cherokee I Shipping Corp	LNG Gemini	20.40	126,340	Moss	9/78	Indonesia-Japan	General Dynamics
46.	Red Methania	Methania	20.00	131,580	Gaz Transport	10/78	Laid-up pending Algeria-Belgium	Boelwerftemse (Belgium)
47.	Cherokee II Shipping Corp	LNG Leo	20.40	126,449	Moss	12/78	Indonesia-Japan	General Dynamics (USA)
48.	Cie Nationale Algerienne	Chihani Bachir	20.00	129,500	Gaz Transport	2/79	Laid-up	CNIM (France)
49.	El Paso Gamma Tanker Co	El Paso Howard Boyd	20.00	126,894	Technigaz	2/79	Laid-up	Newport News Shipbuilding (USA)
50.	Cherokee V Shipping Corp	LNG Libra	20.40	126,443	Moss	4/79	Indonesia-Japan	General Dynamics (USA)
51.	Cherokee III Shipping Corp	LNG Taurus	20.40	126,334	Moss	7/79	Indonesia-Japan	General Dynamics (USA)
52.	Cherokee IV Shipping Corp	LNG Virgo	20.40	126,451	Moss	12/79	Indonesia-Japan from 5/80	General Dynamics (USA)
53.	Lachmar no 1	Lake Charles	20.40	126,529	Moss	4/80	Laid-up	General Dynamics (USA)
54.	Cie Nationale Algerienne de Navigation	Mourad DiDouche	20.00	125,000	Gaz Transport	7/80	Laid-up	Chantiers de L'Atlantique (France)
55.	Lachmar no 2	Louisiana	20.40	126,000	Moss	9/80	Laid-up	General Dynamics (USA)

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	OWNER	SHIP	SPEED (KNOTS)	SIZE(m^3)	DESIGN	DELIVERY	SERVICE	BUILDER
IN SERVICE 1981								
56.	M.I.S.C.	Tenaga Empat	20.00	130,000	Gaz Transport	3/81	Laid-up for Sarawak-Japan chartered from 7/84	CNIM (France)
57.	Cie Nationale Algerienne	Ramdane Abane	20.00	125,000	Gaz Transport	6/81	Laid-up	Chantiers de L'Atlantique (France)
58.	Navifond	Hull 559	20.60	133,000	Gaz Transport	6/81	with yard	Kockums Mekanieska Verstad (Sweden)
59.	M.I.S.C.	Tenaga Dua	20.00	130,000	Gaz Transport	7/81	Laid-up for Sarawak-Japan chartered from 10/83	Chantiers de France Dunkerque (France)
60.	Gotaas-Larsen	Golar Spirit	21.00	129,013	Moss	10/81	Spot(LPG or LNG)	Kawasaki Heavy Industries (Japan)
61.	M.I.S.C.	Tenaga Lima	20.00	130,000	Gaz Transport	11/81	Laid-up for Sarawak-Japan chartered from 1/86	CNIM (France)
62.	Redereit Malmoil	Hull 564	20.60	133,000	Gaz Transport	1981	with yard	Kockums Mekanieska Verstad (Sweden)
63.	M.I.S.C.	Tenaga Tiga	20.00	130,000	Gaz Transport	12/81	To be laid-up for Sarawak-Japan chartered from 4/85	Chantiers de France Dunkerque (France)
ON ORDER 1982								
1.	M.I.S.C.	Tenaga Satu	20.00	130,000	Gaz Transport	3/82	Sarawak-Japan chartered from 1/83	Chantiers de France Dunkerque (France)
2.	NYK/Mitsui OSK/K line •	Hull 1334	19.30	125,000	Moss	12/82	Indonesia-Japan (Badak)	Kawasaki Heavy Industries (Japan)
1983								
3.	NYK/Mitsui OSK/K line •	Hull 1870	19.30	125,000	Moss	1/83	Indonesia-Japan (Badak)	Mitsubishi Heavy Industries (Japan)
4.	NYK 40% MOSK 30% K line 15% Japan line 15%	Hull 1889	19.30	125,000	Moss	5/83	Indonesia-Japan (Arun)	Mitsubishi Heavy Industries (Japan)
5.	NYK/Mitsui OSK/K line •	Hull 1230	19.30	125,000	Moss	10/83	Indonesia-Japan (Badak)	Mitsui Shipbuilding (Japan)
6.	NYK 40% MOSK 30% K line 15% Japan line 15%	Hull 1340	19.30	125,000	Moss	10/83	Indonesia-Japan (Arun)	Kawasaki Heavy Industries (Japan)
1984								
7.	K line 40% NYK 30% MOSK 10% Shinwa 10% Yamashita Shinnihon 10%	Hull 1890	19.30	125,000	Moss	6/84	Indonesia-Japan (Arun)	Mitsubishi Heavy Industries (Japan)
8.	MOSK 40% NYK 30% K line 10% Shinwa 10% Yamashita Shinnihon 10%	Hull 1250	19.30	125,000	Moss	10/84	Indonesia-Japan (Arun)	Mitsui Shipbuilding (Japan)

Note:
Nos 2, 3, and 5 agreed average price Yen 27.6 Billion per ship.
Nos 4 and 6 agreed average price Yen 29.92 billion per ship.
Nos 7 and 8 agreed average price Yen 30.5 billion per ship.

• Equal ownership

TABLE 5 - continued

LNG Carriers Available for Employment During 1982 and Onwards

	NAME	CBM	1982	1983	1984	1985	1986
1.	Pollenger	87,600	x	x	x	x	x
2.	Gastor	122,255	x	x	x	x	x To Pacindonesia
3.	Nestor	122,255	x	x	x	x	x To Pacindonesia
4.	Ben Franklin	120,131	x	x	x	x	x
5.	Hoegh Gandria (a)	125,000	o	o	o	o	o
6.	Golar Spirit	129,013	x	x	x	o	o
7.	Tenaga Satu	130,000	o	To Sarawak-Japan			
8.	Tenaga Dua	130,000	o	To Sarawak-Japan 10/83			
9.	Tenaga Tiga	130,000	x	x	x	To Sarawak Japan 4/85	
10.	Tenaga Empat	130,000	x	x	To Sarawak-Japan 7/84		
11.	Tenaga Lima	130,000	x	x	x	x	To Sarawak-Japan 1/86
12.	Kockums 1	133,000	x	x	x	x	x
13.	Kockums 2	133,000	x	x	x	x	x
14.	El Paso Paul Kayser	120,009	x	x	x	x	x
15.	El Paso Sonatrach	126,165	x	x	x	x	x
16.	El Paso Consolidated	124,989	x	x	x	x	x
17.	El Paso Southern (b)	126,898	x	x	x	x	x
18.	El Paso Arzew (b)	126,929	x	x	x	x	x
19.	El Paso Howard Boyd (b)	126,894	x	x	x	x	x
	TOTAL AVAILABLE FOR CHARTER		16-19	16-17	15-16	13-15	12-14

x = Available for employment in year in question
o = Availability presently uncertain

Possibly available if present LNG pricing problems unresolved

1. Mostefa Ben Boulaid
2. Edward L.D.
3. Chihani Bachir
4. Mourad DiDouche
5. Lake Charles
6. Louisiana
7. Ramdane Abane

Notes: a) On firm charter till July 1982 on Abu Dhabi - Japan trade, thereafter four six months option periods. If options not exercised, vessel will be available. Owners in discussion for long-term charter commencing early 1985 for Indonesia-Korea trade if this is concluded successfully.
b) Under U.S. flag and Title XI financing which presently may restrict vessel to trading on a long-term basis to a U.S. port.

Source: Gotaas-Larsen

LEGAL ANALYSIS

I. Introduction

The Alyeska trans-Alaska oil pipeline (TAPS), which supplies a substantial portion of America's energy today, was built only after a Vice President's vote broke a deadlock over enabling legislation in the United States Senate. TAGS, a project with financial and engineering challenges of similar magnitude, again requires government decisions before construction. The importance of government concurrence in this private project can not be underestimated.

The Committee's counsel, the Alaska and Washington, D.C. based firm Birch, Horton, Bittner, Pestinger and Anderson, has researched the subject of whether these decisions may be made by the President alone, or must include the help of a Congress which has already spent considerable time on Alaska natural gas transportation issues. The Committee's direction has been to examine the issue with an eye toward swift government decision-making while taking into account the body of laws, regulations and treaties which represent America's concerns over energy supplies, the environment, foreign trade and investment.

Counsel's findings are presented here in a question and answer format with further summaries on five issues important to any project sponsor's attempts to gain permission to construct the system. Additional information on work supplied by counsel can be obtained from the Governor's Economic Committee on North Slope Natural Gas, Box 1700, Anchorage, Alaska 99510.

II. Questions and Answers on Legal Issues Confronting TAGS.

The answers to these questions provide a concise review of the legal issues associated with the Committee's work and the project's feasibility.

1. Question: What law governs the transportation to market of North Slope natural gas?

Answer: The principal federal statute is the Alaska Natural Gas Transportation Act, as amended in 1981 by the "Waiver Package." Secondarily, the Natural Gas Act of 1938, as amended, the Natural Gas Policy Act, the Export Administration Act, the Defense Production Act, and several lesser statutes have some relevance to this subject. Where not preempted by federal law, the State of Alaska also has some statutory authority. This authority is largely based in the jurisdiction of the Alaska Public Utilities Commission to certify pipelines and related facilities, State authority for the control of air and water quality, State statutes protecting the habitats of fish and game, and those responsible for managing land and water resources, including coastal zone management.

2. Question: What are the principal authorities now held by the Alaskan Northwest Natural Gas Transportation Company (hereinafter Northwest)?

Answer: Pursuant to the Alaska Natural Gas Transportation Act (hereinafter ANGTA), Northwest received a conditional certificate of public convenience and necessity from the Federal Energy Regulatory Commission (hereinafter FERC). Such certificates are necessary prior to constructing and operating facilities for the transportation of natural gas subject to federal jurisdiction (*i.e.*, interstate natural gas). In November, 1980, Northwest received a right-of-way permit from the United States Department of Interior, covering the Alaska segment of the Alaska Natural Gas Transportation System (hereinafter ANGTS).

3. Question: Can Northwest's authority to build a pipeline for the transportation of North Slope natural gas be transferred to another entity desiring to build a similar line over the identical route?

Answer: Yes. Existing law permits a new entity to accept assignment or transfer of Northwest's authority so long as it seeks to construct a pipeline of "the basic nature and general route" as the Northwest system. ANGTA imposes a limited number of ownership requirements on a successor entity, but those requirements are quite modest. There have already been changes in the members of the Northwest consortium and assignments of interests thereto, so the precedent for transferability has already been established.

4. Question: Can Northwest's authority be shifted to an entity seeking to build an all-Alaska pipeline to tidewater, with gas conditioned on the North Slope?

Answer: Under existing law, no. ANGTA states that federal officers and agencies shall have no authority to include terms and conditions, in permits issued which would compel a change in the basic nature and general route of the approved transportation system. The Northwest overland pipeline is the transportation system approved by the President and Congress. Moreover, ANGTA does not provide a mechanism whereby the President can change his previous decision once it has been approved by Congress, nor can the President add a second approved route, regardless of whether the initial pipeline applicant has abandoned the project. Therefore, neither FERC nor the Interior Department appear to have the right to transfer the certificate of public convenience and necessity or right-of-way permit to an all-Alaska route sponsor.

5. Question: At what time do Northwest's authorities expire?

Answer: Under existing law, there is no mechanism to define "abandonment" of the project, nor is there a method for restructuring the project upon abandonment. While normal natural gas practice imposes a time limitation on the recipient of a certificate of public convenience and necessity to commence a project, that is not the case with the Northwest system. Northwest's certificate has no time limit for commencement.

6. Question: Does ANGTA preclude an alternate North Slope natural gas pipeline project from becoming a reality?

Answer: Not necessarily. Where a statute imposes significant limitations, the best method for circumventing those restrictions is to avoid the jurisdiction of that statute. While ANGTA has a broad jurisdictional base, there are several ways to escape its jurisdiction. ANGTA applies to "Alaska natural gas," which is defined as "natural gas derived from the area of the State of Alaska generally known as the North Slope of Alaska, including the continental shelf thereof." By applying solely to natural gas, it immediately excludes natural gas liquids (unless they are commingled with natural gas in an interstace pipeline system), and substances derived from the processing of natural gas, such as methanol.

There appears to be no jurisdiction conferred on FERC by ANGTA or the Natural Gas Act covering a pipeline from Prudhoe to tidewater, if the gas transported through the line is not later delivered to the Lower 48. This would be an intrastate pipeline, when ANGTA only applies to interstate pipelines. FERC and other federal agencies have some jurisdiction over exports of the throughput of such a line and, arguably, FERC may have jurisdiction over the terminal facility involved in the export process. If such an intrastate facility was constructed outside the purview of ANGTA, the Department of Interior would not be precluded from issuing a right-of-way permit to its owner.

Another possible approach to avoid the jurisdictional tentacles of ANGTA would be to condition the North Slope gas at tidewater, rather than at Prudhoe Bay, thus characterizing the segment of the project between the wellhead and tidewater as a "pipeline gathering system." As a gathering line, the pipeline would be exempt from FERC certification requirements under the Natural Gas Act and presumably from ANGTA as well.

7. Question: What is a pipeline gathering system?

Answer: The term "gathering system" as used in the natural gas industry refers to collecting gas from wells and bringing it by separate and individual lines to a central point so that it can be delivered into a single line. FERC uses four tests to determine whether a particular system is in fact a "gathering system." Section 717 (b) of the Natural Gas Act excludes facilities for "the production and gathering of natural gas" from its jurisdiction. Thus, production and gathering of natural gas is within the exclusive domain of state regulatory commissions. If the all-Alaska line contemplated were viewed as a "production or gathering line," the project could avoid much federal regulation.

8. Question: How realistic is it to consider a multi-billion dollar, 800 mile project as a gathering system?

Answer: On more than one occasion, FERC has determined that pipeline systems more than 100 miles in length qualify as gathering systems. While the burden of persuasion would be on the applicant seeking to convince FERC that the all-Alaska system is a gathering system, the tests used by the agency in determining whether a particular facility would be exempt under the gathering system exemption give the all-Alaska project a fighting chance of success. The agency determination regarding qualification for the gathering system exemption is always made on a case-by-case basis.

9. Question: Can North Slope natural gas be exported?

Answer: Yes, if certain requirements are met. Unlike North Slope oil, the restrictions on exporting North Slope natural gas are not impossible to meet. The linchpin is Presidential approval. Under ANGTA [15 U.S.C. 719 (j)], export of more than 1,000 Mcf per day of Alaska North Slope natural gas to countries other than Canada or Mexico must receive Presidential approval in order to be permissible, and that approval must be based on a finding that such exports "will not diminish the total quantity or quality, nor increase the total price of energy available to the United States." When this provision was enacted, it probably constituted a nearly insurmountable obstacle. At present, the hurdle may be more illusory than real. Today, the United States is awash in natural gas, and thus it is quite possible that the President could reach and sustain a finding that construction of an Alaska natural gas transportation system would not run afoul of the limitations imposed by this section.

He could determine that the existence of such a transportation system would give the country access to

North Slope gas that is not "available" today, so that exports would not diminish the quantity of energy available in the United States. Nor would the export diminish the quality of energy available, given the overabundance of natural gas. Finally, it would be easy to sustain a finding that export of this gas would not bring about an upward movement of energy prices throughout the United States. We are not predicting that the President will make such a determination, only that an objective review of today's domestic energy picture leads to the conclusion that the section 719 (j) restrictions should not be overestimated. There are other federal statutes that must be satisfied before natural gas, in LNG form, can be exported. These requirements may be found in the Natural Gas Act, the Export Administration Act, the Energy Policy and Conservation Act, and the Natural Gas Policy Act. While these requirements cannot be overlooked, we believe that were the President to make a section 719 (j) finding in favor of North Slope gas exports, the other requirements would fall by the wayside.

10.	Question:	Are there export controls on substances made from natural gas, such as methanol?
	Answer:	There are limited controls on any exports from the United States. Mostly, they arise under the Export Administration Act. Generally, we see no serious restrictions on export of methanol made from North Slope natural gas, or other similar gas-originated substances.
11.	Question:	Are there significant export controls on North Slope natural gas liquids?

Answer: The export controls that would apply to natural gas liquids appear to be quite modest, and again arise primarily out of the Export Administration Act and the Energy Policy and Conservation Act. Natural gas liquids are not regulated under ANGTA or the Natural Gas Act so long as they are not commingled in an interstate gas stream. If the all-Alaska project exports its throughput, then it would not qualify as an interstate pipeline, and the limitations on NGL exports would be minimal.

12. Question: If a small fraction of the gas transported by an all-Alaska system was delivered as LNG to the United States, would that impose greater regulatory requirements on the project?

Answer: Yes. It would materially increase the restrictions on the entire project, regardless of how much of it is devoted to less regulated substances such as NGLs and methanol. When a facility transports some gas interstate, it loses its intrastate exemption and becomes a FERC jurisdictional facility and kicks ANGTA back into operation.

13. Question: Assume an entity sought to build an all-Alaska gas pipeline for delivery of some or all of its throughput to the United States as LNG; what would be the best method for minimizing regulatory and legal problems now facing such a project?

Answer: The fastest, most problem free method of gaining federal approval for such a project would seem to be via amendment of ANGTA or replacement of it by a new, but similar measure. Such legislation could avert drawn-out litigation, motivate federal agencies to act expeditiously and favorably to an all-Alaska project, create the best possible political climate, and inspire confidence in the financial community for such an all-Alaska route. Two pipeline projects have dominated the energy scene in Alaska since 1970: the Trans-Alaska Oil Pipeline System and the Northwest project. Each project required an act of Congress in order to by-pass major hurdles to the project presented by existing federal legislation, administrative regulations, bureaucratic inefficiency, and the threat of long-term litigation. There is every reason to believe that an interstate pipeline successor to Northwest could be benefitted by such legislation, and that Congress may be willing to enact it. We cannot overlook the fact that the North Slope of Alaska contains the Nation's largest proven natural gas reservoir, as well as incalculable potential. The national security benefit of having this domestic hydrocarbon pool available to the country justifies (and already has justified) congressional action. When you add the nationwide economic benefits (employment, industrial production, etc.), as well as possible balance of trade and diplomatic advantages should some exports take place, the ledger tilts very strongly toward the conclusion that a new or modified ANGTA can be extracted from Congress.

14. Question: Are there serious limitations on foreign investment in an all-Alaska gas pipeline project?

Answer: No. There are federal and state statutes regulating foreign investment in domestic energy projects, but these statutes do not effect prohibitions. Generally, they only impose reporting requirements. The legislative history of the Alaska gas pipeline project indicates a willing acceptance by Congress of foreign investment, on both the debt and equity side.

15. Question: How would a decision by private investors and government to reroute an Alaska natural gas transport system affect American agreements with Canada?

Answer: Our relations with Canada over the pipeline are still governed by the Transit Pipeline Treaty, signed in 1977. That treaty, which applies to the ANGTS project, relies on construction being financed through private sources. Neither the Canadian nor the U.S. governments can force private investment in the project.

The Canadians have discovered an extraordinary amount of natural gas in Western Canada and at present have more than 10,000 shut-in natural gas wells in Alberta alone. Canadians are also exploring exports to Japan.

16. Question: What regulatory controls does the State of Alaska have on an all-Alaska pipeline project?

Answer: Where not preempted by ANGTA or other federal law, the State has a good deal of authority over various aspects of the all-Alaska project or a variation of it. The Alaska Public Utilities Commission has jurisdiction over the transportation of LNG exported to foreign markets. Other State agencies would have jurisdiction over other aspects of the project, such as air and water quality, fish and game habitats, and land and water resources. The all-Alaska route system, if not preempted, would have to receive a certificate of public convenience and necessity from the APUC.

III. Summary of Other Research

In addition to the Questions and Answers, a series of legal opinions and supporting original research provided the committee with information on the legal status of a potential all-Alaska natural gas pipeline.

The research submitted by the committee's legal counsel treated a score of issues related to all aspects of the pipeline and dealt in greater depth with some of the areas discussed in the Question and Answer section. The five major areas researched included:

1. To what extent may the current Alaskan Northwest Natural Gas Transportation Company (Northwest) authorities and approvals may be used by an alternative all-Alaska pipeline project?
2. What federal and state regulatory authority would exist over an all-Alaska pipeline that either produced LNG to ship to domestic or foreign markets, or that extracted NGL for shipment to domestic or foreign markets? If the natural gas or NGL options were combined in some percentage mix, would any of the regulatory conclusions be changed?
3. Could an all-Alaska pipeline be considered a gathering system under the Natural Gas Act and thereby avoid FERC certification requirements?
4. What federal and state restrictions exist related to foreign investment in a pipeline project?
5. What federal and state regulatory approvals of all types, including test results and environmental studies, currently in existence with respect to the Northwest project, could be used by an all-Alaska system following all or part of the Northwest route?

The research provided by the committee's legal counsel on each of these five areas has been summarized.

1. TO WHAT EXTENT MAY THE CURRENT ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY (NORTHWEST) AUTHORITIES AND APPROVALS BE USED BY AN ALTERNATIVE ALL-ALASKA PIPELINE PROJECT?

Northwest currently holds two major authorities necessary for construction and operation of an Alaskan gas pipeline -- a conditional certificate of public convenience and necessity issued by the Federal Energy Regulatory Commission (FERC) pursuant to the Alaska Natural Gas Transportation Act (ANGTA) and a right-of-way permit granted by the Department of the Interior. A new entity seeking to construct a pipeline of the same basic nature and general route as the Northwest system can have Northwest's authority transferred to it, provided it meets a set of designated ownership requirements. These ownership requirements are quite modest. The Department of the Interior and other agencies that have issued permits to Northwest would appear to have the same ability to approve transfer to a new entity.

If the new entity desires to construct an all-Alaska pipeline to transport Prudhoe Bay gas to Fairbanks and then to tidewater for ultimate delivery in whole or in part to the lower 48, the authorities held by Northwest do not appear transferable and/or modifiable. We so conclude because the Alaska Natural Gas Transportation Act states that federal officers and agencies shall have no authority to include terms and conditions, or to take actions, if said terms and conditions or actions would compel a change in the basic nature and general route of the approved transportation system. The Northwest Alaska overland pipeline is the approved transportation system.

ANGTA does not permit the President to act once Congress has approved the pipeline applicant chosen by him, which it did in 1977. Therefore, under existing law, the President cannot propose an additional Alaska gas pipeline applicant, nor can he change his predecessor's decision and replace Northwest with another applicant.

With regard to the Alaska Natural Gas Transportation System, there is no statutory provision disposing of the issue of project abandonment by virtue of non-performance. Under standard gas pipeline law, certificates of public convenience and necessity generally include time periods for performance after which they lapse. The conditional certificate held by Northwest has no such time period. As a result, we must conclude that the issue of whether Northwest has abandoned the project, and when, if ever, its grant of authority lapses, would have to be litigated. If Northwest took affirmative action pronouncing to the FERC that it permanently abandon the project, the streamlined mechanism under ANGTA is not resurrected for the President to choose an alternate applicant.

Additionally, the option of going through a standard comparative certification proceeding at FERC may or may not exist subsequent to a Northwest abandonment, depending on one's interpretation of ANGTA's duration and preemptive character.

There appears to be no ANGTA or FERC jurisdiction over an intrastate pipeline from Prudhoe Bay to tidewater, if the gas transported through the line is not later delivered to the lower 48. Such a system would not be an interstate gas transmission system. FERC and other federal jurisdiction over the export of the throughput of such a line would exist in the form of export license requirements, etc. Arguably, FERC may have jurisdiction over the terminal facility involved in the export process.

Neither the Alaska Natural Gas Transportation Act nor the Natural Gas Act would appear to give FERC jurisdiction over certification and operation of an intrastate line, if the throughput of that line is converted to a processed commodity that is neither natural gas nor LNG (nor associated gases, such as methanol). Our limited research on this point indicates that such processed end product could be sold in the lower 48 or exported without incurring FERC jurisdiction.

Our conclusions regarding the transferability of Northwest's certificates and permits under the ANGTA derive from a combination of legal analysis and the practicalities of developing a major energy project like an all-Alaska gas pipeline entity. Since there is little case law regarding ANGTA, it is possible that if litigated, more flexibility would be found in the statute by Federal Courts than we have asserted. However, the prospect of protracted litigation on a multitude of technical legal interpretations of ANGTA provisions is tantamount to a prohibition, regardless of the outcome of the litigation, since the endless delay and uncertainty attached thereto would make capital acquisition extremely difficult if not impossible.

The fastest, most problem free method of gaining federal certification, either new or transferred from Northwest, from an all-Alaskan line that would have maximum market and product flexibility is through amendment of ANGTA, or replacement of it by a new, but similar measure. Such legislation would proscribe drawn-out litigation, motivate federal agencies to act expeditiously and favorably, create the best possible political climate, and inspire confidence in the financial community for such an all-Alaska route.

2. FEDERAL AND STATE REGULATORY AUTHORITY OVER GAS SHIPMENTS

A. FEDERAL AUTHORITY OVER SHIPMENT OF LNG TO FOREIGN AND DOMESTIC MARKETS

Many layers of Federal jurisdiction exist over the shipment of LNG to foreign and domestic markets. With regard to export of LNG to foreign markets: under the Natural Gas Act of 1938, and related Executive Orders, the Economic Regulatory Administration (ERA) has jurisdiction to approve the exportation of the gas; the Federal Energy Regulatory Commission (FERC) may have jurisdiction to certify the LNG facilities; the Office of Energy Emergency Operations has jurisdiction to approve export facilities at a United States border; under ANGTA, the President must approve the export of Alaska natural gas in excess of 1,000 Mcf per day to countries other than Mexico and Canada. Under the Energy Policy and Conservation Act of 1975 and the Export Administration and Defense Production Acts, the Department of Energy also has authority to restrict LNG export for national security or energy conservation purposes in times of national emergency or energy shortages. In addition, other federal agencies have jurisdiction over other aspects of an LNG project such as the construction, safety and design of facilities, and the protection and control of the coastal and marine environment.

With regard to shipment of LNG to domestic markets, FERC has jurisdiction to certify the LNG facilities used as part of the interstate transportation of LNG.

B. STATE AUTHORITY OVER SHIPMENT OF LNG TO FOREIGN AND DOMESTIC MARKETS

Certain state agencies would also have authority over various aspects of an LNG project. The Alaska Public Utilities Commission (APUC) could have jurisdiction over the transportation of LNG exported to foreign markets, to the extent this authority is not preempted under the Natural Gas Act. This authority would certainly be preempted if the LNG is shipped to domestic markets, however. Other state agencies would have jurisdiction over other aspects of an LNG project, in order to administer state controls over air and water quality, fish and game habitats and land and water resources.

C. FEDERAL AUTHORITY OVER SHIPMENT OF NATURAL GAS LIQUIDS TO FOREIGN AND DOMESTIC MARKETS

Federal authority exists in fewer areas over the shipment of NGLs to foreign and domestic markets. Concerning export of NGLs to foreign markets, the Department of Energy does not have jurisdiction to approve either the export of the product or the construction and operation of facilities because NGLs are not subject to the Natural Gas Act. Also for this reason, the Department of Energy would not have jurisdiction over interstate shipment of NGLs, as long as the liquids were not commingled with jurisdictional gas. While the definition of natural gas in ANGTA is broad, it almost certainly does not reach NGLs, so we doubt that the President would have to approve exports of NGLs derived from greater than 1,000 Mcf of natural gas. Export of NGLs is regulated under the Energy Policy and Conservation Act, the Export Administration Act and the Defense Production Act. Other federal agencies have authority over the construction, safety and design of facilities and the protection and control of the coastal and marine environments.

D. STATE AUTHORITY OVER SHIPMENT OF NATURAL GAS LIQUIDS TO FOREIGN AND DOMESTIC MARKETS

1) APUC Jurisdiction: No Certification of Natural Gas Liquid Facilities Required

Gas processing plants, treaters and separators are specifically excluded from the definition of pipeline facilities subject to the jurisdiction of the APUC under A.S. 42.06.603(10). Therefore, the APUC does not have jurisdiction to certify any NGLs separation facility in conjunction with certification of an intrastate natural gas transportation system.

2) Other State Authority Over Shipment of Natural Gas Liquids to Foreign or Domestic Markets

In Section II 1. of this memorandum, we discussed the host of other state agencies which would have jurisdiction over a project which produced LNG for export or shipment to the lower 48 states. These state agencies would have the same jurisdiction over the construction and operation of a pipeline project and related marine facilities and transportation for a project which produced NGLs.

F. THE EFFECT OF COMMINGLING NATURAL GAS AND NATURAL GAS LIQUIDS ON FEDERAL JURISDICTION

As discussed above, since NGLs are not considered natural gas under the Natural Gas Act, neither the sale nor the transportation of NGLs is subject to FERC jurisdiction. If the NGLs are transported in a commingled fashion with jurisdictional natural gas destined for shipment to domestic markets, however, certain aspects of FERC jurisdiction would be triggered. According to Cities Service Gas Co. v. United States, 50 F.2d 448 (Ct. Cl., 1974), the FERC would have jurisdiction to control the movement, transportation, measurement, curtailment, quantity, certification and abandonment of the sale of all the gas, but would have no authority over the rates set for the sale of non-jurisdictional gas:

The FPC has jurisdiction of all gas moving in a pipeline in interstate commerce even if interstate gas and intrastate gas are commingled, and even if the interstate gas is only a small part of the total gas in the pipeline. We find no difficulty with this proposition and agree that it is the law. However, this does not tell the whole story. The jurisdiction vested in the FPC authorized it to control the movement and transportation, measurement, curtailment, quantity, certification and abandonment of sale of gas moving in interstate commerce or in an interstate pipeline, but the FPC has no authority or jurisdiction to fix the rates of all gas sold in interstate commerce.

Therefore, FERC jurisdiction would be increased over NGLs, if the liquids are commingled with jurisdictional natural gas.

3. CAN AN ALL-ALASKA GASLINE BE TREATED AS A PIPELINE GATHERING SYSTEM THEREBY PARTIALLY AVOIDING FEDERAL REGULATORY JURISDICTION?

A. Overview

The premise of treating an all-Alaskan gasline as a gathering system for North Slope gas with a terminal at tidewater has been raised on a number of occasions. The assumption is that an all-Alaskan line could be designed as a gathering system as a means of exempting the line from federal regulatory jurisdiction. Section 1 (b) of the Natural Gas Act [15 U.S.C. S 717 (b)] exempts from regulation (under the Natural Gas Act) transportation or sale of natural gas, the local distribution of natural gas, the facilities used for such distribution or the "production or gathering of natural gas".

As noted, a natural gas company is engaged in the transportation of gas in interstate commerce if it transports gas "between any point in a state and any point outside thereof . . . but only insofar as such commerce takes place within the United States" 15 U.S.C. 717(a). It has been held that transportation of gas by a pipeline located wholly within Texas to an industrial consumer who in turn transports gas into Mexico was not transportation or sale of natural gas in interstate commerce. Border Pipeline Co. v. Federal Power Commission, 717 F.2d 149 (App. D.C. 1948). Thus, any project which would export exclusively for foreign sales, natural gas from the North Slope or gas products derived therefrom, may automatically be exempted from the purview of the Natural Gas Act insofar as pipeline regulation and pricing is concerned. Such an entity would, however, still be subject to FERC approval pursuant to 15 U.S.C. 717(b) insofar as exports of natural gas are concerned.

Assuming, however, that the ultimate market for natural gas includes domestic markets, the Natural Gas Act does not apply to "the production and gathering of natural gas." 15 U.S.C. 717(b). Thus, production and gathering of natural gas is within the exclusive domain of state regulatory commissions. If the all-Alaskan line contemplated were viewed as a "production or gathering line" the project could avoid much federal regulation including the FERC ratemaking authority.

It has been consistently held that "production" and "gathering" are terms narrowly confined to the physical acts of drawing the gas from the earth and preparing it for the first stages of distribution. Northern Natural Gas Co. v. State Corporation Commission of Kansas, 372 U.S. 84, 90 (1963).

See also Phillips Petroleum Co. v. Wisconsin, 347 U.S. 672 (1954); Continental Oil Co. v. FPC, 226 F. 2d 202 (C.A. 5th (1955); J.M. Huber Corp. v. FPC, 236 F. 2d 550 (C.A. 3, 1956) cert. den. 352 U.S.C. 971 (1956).

One thing can be counted on: any review of an attempt to exempt an all-Alaskan project from regulation under the Natural Gas Act (except for export requirements) is likely to be reviewed in light of four principles of construction which have been consistently applied to the Natural Gas Act as a whole.

First, the Act was intended to protect the consumer from the economic power of natural gas companies and thus must be construed, whenever possible, as consistent with that purpose. See Panhandle Eastern Pipeline Co. v. Federal Power Commission, 324 U.S. 635 (1945); Interstate Natural Gas Co. v. Federal Power Commission, 331 U.S. 682 (1947); Phillips Petroleum Co. v. Wisconsin, 347 U.S. 62 (1954); United States Gas Improvement Co. v. Continental Oil Co, 381 U.S. 392 (1965); J.M. Huber Corp. v. Federal Power Commission, supra; Saturn Oil and Gas Co. v. Federal Power Commission, 250 F.2d 61 (1957); Re Colombian Fuel Corporation, 15 PUR 3d 1975 (FPC, 1940).

Second, the Act is almost always liberally construed to carry out the congressional intent behind it: to fill in with a federal presence the regulatory gap caused by pre-1938 judicial decisions which prevented states from regulating interstate flow of natural gas. See Interstate Natural Gas Co. v. FPC, supra; and Federal Power Commission v. Panhandle Eastern Pipeline Co., supra.

Third, the burden of persuasion that a pipeline or facility comes within the exceptions to the Act is to be carried by the proponent and is a heavy burden to bear. See Interstate Natural Gas Co. v. FPC, supra; Phillips Petroleum Co. v. Wisconsin, supra; J.M. Huber Corp. v. Federal Power Commission, supra; Saturn Oil and Gas Co. v. Federal Power Commission, supra; Re Arco Oil Corp., 15 FPC 601 (FPC, 1956).

Finally, it is clear that the actual function of the facility will be the determinative factor as to whether the exclusion in Section 1(b) of the Natural Gas Act applies. Descriptive terminology used within the industry cannot override the actual function of the facilities being examined. J.M. Huber Corp. v. Federal Power Commission, supra; Continental Oil Co. v. Federal Power Commission, 266 F 2d 208 (C.A. 5, 1959); Ben Bolt Gathering Co. v. Federal Power Commission, 323 F 2d 610 (C.A. 5, 1963); Re Northern Natural Gas Co., supra; Re Barnes Transportation Co., 20 P.U.R. 3rd 247 (FPC, 1957); and Re Marathon Oil Co., 10 P.U.R. 4th 198 (FPC, 1975).

There are three tests which have been used by the FERC, and the FERC's predecessor, the FPC, in determining whether a particular facility would be exempted pursuant to 1(b) of the Natural Gas Act.

The first test is known as the "central point test." Under this view of the exclusion, if particular facilities actually function as gathering lines in that they collect gas from various wells, bring the gas through several individual lines to a "central point" and deliver the gas into a single line, all facilities up to the single line are considered gathering facilities. Re Barnes Transportation Co., Inc. 18 F.P.C. 369 (1957).

Under the "central point test," gathering ends when the gas collected ends up in one line. The application of this test appears to be limited to pipeline systems which do not include a processing plant. See Buckeye-Tennessee Gas Gathering Co. Declaratory Order Disclaiming Jurisdiction, Docket No. CP80-386 (Aug. 28, 1980). As such, the test would seem inapplicable to an all-Alaskan pipeline system because of the need for a facility to clean the gas at tidewater.

The second test used to distinguish between transportation and gathering is the "behind-the-plant test" (sometimes referred to as the "pipeline quality test"). Under this test, jurisdiction pursuant to the Natural Gas Act commences when gas of pipeline quality leaves the tailgate of the processing plant. Any facilities located upstream from the gas processing plant are gathering facilities. See Superior Oil Co., Order Disclaiming Jurisdiction, Docket No. CP80-495 (Dec. 15, 1980); Northern Natural Gas Pipeline Co., Opinion No. 538, FPC 362 (1968). This test may be applicable to an all-Alaska project. In general, FERC has applied the test to facilities owned and operated by the seller of the gas in question. When third parties operate the facilities, the FERC has found the facilities to come within its jurisdiction. See Texas Sea Rim Pipeline, Inc., Declaratory Order Docket No. CP79-117, pp 3-4 (Feb. 16, 1979). But, See Philadelphia Oil Co., Order Affirming Initial Decision, Docket No. C175-52 (Jan. 18, 1977) which indicates that no matter who transports, the function of gathering is what the FERC will focus in on.

The third test is known as the "primary function test." It asks what the primary use of the facilities will be. All facts are considered in view of the entire transmission facility. See Ben Bolt Gathering Co., 26 FPC 825 (1961) Aff'd 323 F. 2d 610 (5th Cir. 1963); Marathon Oil Co., Opinion No. 735, 53 FPC 2164 (1975). Here again, an all-Alaska system carrying CO_2 laden gas to tidewater where it would be cleaned might be considered part of a sophisticated gathering system necessitated by the unique transportation barriers imposed by the Alaskan environment and patterns of land ownership.

As noted, decisions as to whether the 1(b) exemption applies are made on a case by case basis. The burden of proof would be on the all-Alaska project. While skeptics may quote otherwise, an all-Alaska line carrying CO_2 laden natural gas to a tidewater processing plant may qualify.

But FERC always has the ability to step in and exert jurisdiction to "fill the regulatory gap." No unfair advantage can result from a FERC decision not to regulate rates charged for the gathering. See Buckeye-Tennessee Gas Gathering Co., Declaratory Order Disclaiming Jurisdiction, Docket No. CP80-386 (Aug. 28, 1980); Carnegie Natural Gas Co., Order Disclaiming Jurisdiction, Docket No. CP77-535 p. 2 (Sept. 29, 1978).

Thus the answer as to whether an all-Alaska system would be considered to be a gathering or transportation system for purposes of distinguishing FERC jurisdiction under the Natural Gas Act is dependent on the application of the above test to the facts. The presence of significant amounts of carbon dioxide in the gas to be transported to tidewater might be enough in and of itself to exempt the facility from FERC jurisdiction. As with most things Alaskan, any decision rendered with regard to the question will be made on the basis of this case alone.

Finally, any line crossing federal lands which is not subject to the Natural Gas Act and which is not serving as a public utility regulated by the state must act as a common carrier. 30 U.S.C. 185 (r). Likewise, a similar provision in the State's Right-Of-Way Leasing Act provides that if the line is not regulated by the federal government pursuant to the Natural Gas Act and does not serve as a state regulated public utility, then it must act as a common carrier, A.S. 38.35.120(1). Thus, it appears that by avoiding regulation under the federal Natural Gas Act of 1938, the pipeline may have to become a common carrier and must accept all gas tendered to it equally. It does not necessarily mean the line is subject to FERC regulation, however.

4. REGULATION OF FOREIGN INVESTMENT IN AN ALL-ALASKA GAS PROJECT

Foreign investment in the United States has existed from the earliest federation days. With certain exceptions, most notably pertaining to national security and defense, such investments have been encouraged and welcomed. Constitutional limitations exist which affect both federal and state regulation of foreign investment. Further, the United States has concluded many commercial treaties and other agreements which have the full force and effect of federal law, thus further impacting federal and state efforts to regulate foreign investment.

5. EXISTING NORTHWEST REGULATORY APPROVALS AND TEST STUDIES WHICH COULD BE USED BY AN ALL-ALASKA ROUTE ENTITY

Northwest has received many regulatory approvals and has conducted many test studies during the planning and pre-operation state of the pipeline. While an all-Alaska route entity would have to apply for its own permits for specific activities, much of the information which has been analyzed and collected by Northwest could conceivably be used as supporting information. Northwest has filed the bulk of this information on a confidential basis. No one has challenged that status under the state's freedom of information statute, but no challenge would be necessary on the part of a TAGS sponsor if an amicable agreement were worked out with Northwest.

APPENDIX III

Additional Material Submitted for the Record

Statement of

ARLON R. TUSSING AND CONNIE C. BARLOW
ARTA, Inc.

THE OUTLOOK FOR MARKETING NORTH SLOPE NATURAL GAS

Prepared for a Hearing on
MARKETING ALTERNATIVES FOR ALASKA NATURAL GAS

United States Senate
Committee on Energy and Natural Resources
Subcommittee on Energy Regulation

November 15, 1983

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SUMMARY AND CONCLUSIONS

From a late-1983 standpoint, the Alaska Natural Gas Transportation System (ANGTS) as the sponsors conceived and designed it, and as the President and Congress authorized it, is not an economic venture. No alternative, however, whether a liquefied natural gas (LNG) export project or a methanol-fuel system, seems to hold any greater promise.

At the construction costs implied by the system design, present market interest rates, and the rates of return to equity contemplated by the sponsors and the regulatory bodies having jurisdiction over the system, it seems unlikely that anything resembling ANGTS will ever be able to deliver natural-gas energy to the Lower-48 states at a price consumers would be willing to pay.

Major improvements in the economics of ANGTS could undoubtedly be achieved through increasing the pipeline's scale to accomodate a larger daily gas flow, and through adopting a different design and engineering philosophy. We believe that the policy most likely to result in these improvements would be to deregulate the entire system --- including the wellhead price of North Slope gas, and the pipeline's capital structure, tariff, and rate of return. The present project is nevertheless so far from being economically feasible that we can not foresee any combination of internal project changes (changes in design, organization, or in gas-marketing or financing strategy), or regulatory and legal changes that would assure construction and operation of the system, short of a direct federal construction guarantee and operating subsidy.

This conclusion stems from a number of developments in the structure of natural-gas demand in the United States, the world oil-price and supply outlook, general price-level trends, and capital-market conditions. Not every analyst will agree with our views on all of these issues, and unforeseen developments might substantially change the outlook on any of them. The fact that we might be wrong on one or a number of these questions may be beside the point, however: **Sufficient uncertainty and controversy now exist on the crucial issues that investors cannot help but regard ANGTS --- or any North Slope gas-delivery system --- as an unacceptably speculative venture.**

Among the alternatives to ANGTS proposed for early marketing of North Slope gas, only two have sufficient plausibility or support to deserve serious examination today. A committee of former Alaska governors has proposed a gas pipeline from Prudhoe Bay to a terminal on Cook Inlet, where North Slope gas would be liquefied for Far Eastern markets. The attractiveness of this project does not rest on its ability to achieve a lower capital or operating cost than ANGTS, which we regard as doubtful, but on the even more doubtful proposition that the market value of Alaska gas landed in Japan as LNG would be substantially higher than the value of incremental gas supplies delivered into the Lower 49 states.

The other plausible alternative to ANGTS involves converting North Slope gas to fuel-grade methanol, which would be shipped through the existing oil pipeline (TAPS) in batches or as a blend with crude oil, or else carried in submarine barges under the Arctic ice cap. Even if one or more of these transportation options were clearly feasible (and each of them is problematical), the only market large enough to absorb all the methanol that would be produced on the North Slope would use as boiler fuel, where it would have to compete with Lower-48, Canadian and Mexican natural gas, and with residual oil and coal, all of whose current prices are less than the anticipated manufacturing cost of methanol, even without considering transportation cost for the methanol or any wellhead price for the gas itself.

Over a decade or two, other market or technical developments might make some variant of ANGTS, one of these alternatives, or some other system feasible (for example, LNG shipments directly from the North Slope by icebreaking tanker or submarine barge). Large volumes of gas might be put to use as fuel for thermally assisted extraction of heavy crude oil, huge volumes of which exist in the vicinity of Pruhdoe Bay. None of these options is clearly visible enough today for anyone to take seriously as a **planning or investment option.**

In our view, therefore, something resembling ANGTS still appears to be the strongest of a weak lot, but the conditions which would make it a viable option are still beyond the horizon.

PREFACE

In this statement, we have updated the essential elements (1) a report we submitted to the U.S. General Accounting Office in late 1982 (The Struggle for an Alaska Highway Gas Pipeline: What Went Wrong?), and (2) our article in the Summer 1983 Natural Gas Insights ("An Epitaph for the Alaska Gas Pipeline: Will Alaska Gas Ever Get to Market?")

About the Authors. Arlon R. Tussing is professor of economics in the Institute of Social and Economic Research of the University of Alaska, and president of ARTA, Inc., an economic consulting firm based in Seattle Washington. Connie C. Barlow is vice-president of ARTA Inc., and manages ARTA's Juneau, Alaska office.

Tussing and Barlow have both been involved with Alaska natural-gas planning and policy matters and with ANGTS in particular, since before the formal emergence of the Alaska Highway gas-pipeline proposal in 1976. In the mid-1970's, Tussing was a member of the State of Alaska's Oil and Gas Royalty Board, and also served as chief economist of the U.S. Senate Committee on Interior and Insular Affairs (now the Committee on Energy and Natural Resources). In this capacity, he staffed the deliberations that led to passage of the Alaska Natural Gas Transportation Act, and organized committee hearings on that Act. During the same period, Barlow was special assistant to the President of the Alaska State Senate and subsequently Special Assistant to the Commissioner of Natural Resources, with responsibility for gas-sales and transportation issues.

After President Carter selected the "Alcan" pipeline proposal in 1978, Tussing and Barlow collaborated on a series of policy and financial analyses of the pipeline project for the Alaska State Legislature. They have subsequently advised several private and governmental entities in the United States and Canada on ANGTS and other Arctic gas-transportation projects.

Background Reading. The historical and analytical background to the present statement appears in several books and articles by the authors. We urge those readers who are not familiar with the organization, economic dynamics, and regulation of the natural-gas industry in the United States to begin with "The Rise and Fall of Regulation in the Gas Industry" (which has appeared in the March 4, 1982 Public Utilities Fortnightly and the October 1982 Energy Journal), followed by Introduction to the Gas Industry (prepared for the Alaska Legislature in 1978) and Marketing and Financing of Supplemental Gas (prepared for the U.S. Department of Energy in the same year).

Further suggested reading on the revolution in U.S. natural-gas markets that has radically altered the outlook for ANGTS include the authors' address to the 1982 meeting of the Interstate Natural Gas Association of America (INGAA) --- published in the February 3, 1983 Public Utilities Fortnightly under the title "A Survival Strategy for Gas Pipelines in the Post-OPEC Era", and Tussing's statement on "Canada's

Gas Exports: Farewell to the Seller's Market" at the Financial Post conference on gas exports, Toronto, February 23-24, 1983.

The Natural Gas Industry: Evolution, Structure, and Economics, by Arlon R. Tussing and Connie C. Barlow, will be published by Ballinger in late 1983.)

The authors have covered various economic, regulatory, and political issues regarding ANGTS in The Proposed Alaska Highway Gas Pipeline: Roots of the Present Impasse, and Financing the Alaska Highway Gas Pipeline: What is to be Done? (prepared for the Alaska Legislature in 1978 and 1979, respectively). Other related works include Barlow's Natural-Gas Conditioning and Pipeline Design ("A Technical Primer for Non-Technicians, with Special Reference to Hydrocarbons from Prudhoe Bay, and the Alaska Highway Gas Pipeline"), prepared by ARTA in 1980 for the Alaska Department of Natural Resources, and Barlow and Tussing, "Use in Alaska of North Slope Natural Gas: A Survey of Prospects and Likely Impacts on an Alaska Gas Pipeline," prepared for the U.S. General Accounting Office and published in the October 1980 Alaska Review of Social and Economic Conditions.

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I. INTRODUCTION

The Prudhoe Bay field on Alaska's North Slope holds the biggest known crude-oil deposit ever found in the United States and one of the largest accumulations of natural gas. Discovered in 1968, the field has been producing crude oil for Lower-48 markets since 1977 but, in the absence of a gas-transportation system, almost all of the natural gas produced in conjunction with the oil has so far been reinjected into the reservoir.

Congress passed special legislation in 1976, 1977, and 1982 to smooth the way for an Alaska Natural Gas Transportation System (ANGTS), and the United States has entered into a compact with Canada expressly to advance ANGTS construction.

Thirteen years after the Prudhoe Bay field was discovered, however, and five years after the U.S. and Canadian governments approved the system configuration and sponsoring parties, the latter have yet to produce a credible financing strategy or plan. In mid-1983, the project is stalled, and its future is in serious doubt. **This statement contains our assessment of what went wrong, and what, if anything, could now be done to get Alaska North Slope gas to market.**

II. EXTERNAL EVENTS THAT DAMAGED ANGTS

The most damaging problems for ANGTS have been those over which the sponsors had no control. The two most crucial developments, unanticipated by the sponsors and by most governmental bodies concerned with ANGTS, have been (A) a fundamental revolution in the structure and behavior of natural-gas markets in North America, and (B) an interruption, and possibly the end, of the rise in world oil prices that began in 1973. The project's difficulties have also been exacerbated by (C) a general economic environment that included high and (until recently) accelerating rates of inflation and market interest rates.

A. The Revolution in U.S. Gas Markets

The most dramatic change in circumstances has been the end of gas shortages and the appearance of widespread gas surpluses. Pipelines that were being sued by gas distributors only five years ago for failing to **deliver** contracted volumes of gas are now being sued by upstream sellers for failing to **take** as much gas as they have promised to buy. Throughout the United States, producers, pipelines, and distributors are finding that they have more gas available than they can sell. In 1983, most U.S. gas markets have not merely "cleared" but have, indeed, swung beyond their market-clearing equilibria.

The most important source of this change was the Natural Gas Policy Act of 1978 (NGPA), enacted the year after the President and Congress selected the sponsors and the route of the ANGTS project. The NGPA initiated a partial and phased relaxation of wellhead price controls, thereby encouraging producers to find and develop more gas and allowing interstate pipelines to bid away "surplus" gas from intrastate markets. Higher prices for domestic gas under the NGPA have not been the only causes of gas-price increases: Imports of foreign pipeline gas and LNG at prices substantially above the pipeline companies' average gas-acqusition costs, plus a steady stream of investments by pipelines and gas utilities, which raised transmission and distribution costs, have also contributed to a steep "fly-up" in consumer gas prices since 1978.

Obsessed by memories of supply curtailments in the 1970s, the interstate pipelines bought large quantities of high-priced gas, including domestic gas in categories that NGPA freed from price controls, gas formerly confined by regulation to intrastate buyers, and foreign supplies. Virtually disregarding the fact that most of this gas was priced well above its final-market value, the transmission companies' gas-acquisition programs far overshot their mark. By mid-1982, too much gas had already come into the system on long-term contracts with rigid "minimum-take" provisions, and at prices too high to resell.

Although Congress conceived of the NGPA as a gradual approach to the deregulation of **wellhead prices for new gas in 1985,** in reality the new law has meant the **rapid and total deregulation of final consumer prices for all gas.** Higher retail prices have dramatically restrained consumption, completing the course toward "market clearing" at least two or three years earlier than most industry or government analysts imagined.

High prices began to drive industrial customers from a few pipelines and gas-distributors to alternate fuels as early as 1979, and by 1982, most systems in the United States were losing major portions of their industrial loads to the economic recession, conservation, or substitution of residual oil and coal. Households and other consumers who lack ready access to a lower-price substitute have also been consuming less and less gas, in repsonse to its higher price. Load losses, in turn, forced up prices even further as "take-or-pay" contracts required pipelines to pay for gas they could not sell, and as each unit of gas sold had to bear a bigger portion of pipeline and utility fixed costs, and as contract provisions gave pipelines with excess supplies little choice but to shut in their cheapest rather than their most costly gas.

The Long-Term Gas-Market Outlook. Many, if not most, industry spokesmen and gas-market analysts have so far dismissed the current gas surplus as a "bubble", which will give way to new shortages once the national economy turns up and the inexorable decline they foresee in domestic gas reserves reasserts itself. As ANGTS is a 25-year venture, at least (30 years, considering construction time), today's gas-market conditions therefore do not necessarily determine the project's economic merits or viability, which must be measured over its entire expected service life. The ANGTS sponsors expressly endorsed such a view when they presented the testimony of Jensen Associates at the October 1981 Congressional hearings on the waiver package:

> "Prior to new gas price decontrol in 1985, gas demand will grow in the price-sensitive industrial and power-generation sectors as the gap between gas and fuel oil remains. By 1983 this increasing demand will have absorbed the current gas supply surplus and exceeded available supply, creating an imbalance period lasting until decontrol of new gas prices in 1985."

This forecast was, at best, poorly timed. While the present gas glut has proved more durable than authorities like Jensen foresaw, the acute surplus of deliverability and the "market disorder" attending it (for example, the tendency of pipelines to shut in their relatively cheap gas in favor of producing high-priced gas subject to "take-or-pay" terms) are only phenomena that are peculiar to the transition from regulation to deregulation. We concur in the industry consensus that the surplus will mostly disappear as contracts are renegotiated at lower prices and minimum-take rates, and as the flow of new delivery capacity onto the market slackens.

Today's surplus will not, however, be replaced by a new era of chronic shortages and curtailments, nor is the rest of the outlook we have described likely to change, barring a stricter re-regulation of gas prices than any member of Congress has yet publicly proposed. In order to reach this conclusion it is only necessary to recognize, (1) that the "marginal" use of natural gas is as an industrial or electric-utility boiler fuel, (2) that gas markets have already "cleared" at or below the prices of alternative boiler fuels, and (3) that the marginal gas consumer in the United States will **continue to be** a boiler-fuel user with an alternative fuel source --- for as far into the future as it is prudent for anyone in the energy industries to plan.

These truths do not depend upon any particular assumption about the next decade's Lower-48 gas-discovery rates, nor does it depend upon the strength and timing of the general economic recovery. Likewise, it is not crucial exactly how much more gas homeowners and small businesses conserve in response to the recent price fly-up. Since de facto deregulation permits high-value gas uses (residential, commercial, and process-fuel use) to bid whatever gas they need away from low-value uses --- **no addition to the nation's gas supply will be worth more than the cheapest fuel it displaces, whether that fuel be residual oil, coal, or gas from other sources.**

With this understanding, there are eight propositions that sponsors of ANGTS or any other high-cost gas-supply project must face:

First and most fundamentally, gas shortages of the kind experienced in the 1970s are gone for good.

Deregulation of **wholesale gas prices** is already a reality **from the point of view of gas-distribution companies and many of the pipelines'** direct-sales customers (though not yet for "old-gas" producers who are locked by regulation into below-market prices for most of their gas). No legislative or regulatory initiative, state or federal, is in sight which could prevent the retail gas prices faced by all classes of consumers from reaching and remaining at the highest levels the market will bear.

As a result, there will henceforth be as much gas available in the market as any pipeline, distributor, or industrial gas-consumer is willing to pay for. No one now or in the foreseeable future will have to scramble for gas he doesn't need today or can't resell at today's prices, just in order to avoid **future** curtailments.

Second, the marketplace does not regard gas as a "premium fuel". the market value of an incremental gas supply is, at most, its price-equivalent in high-sulfur residual oil.

Contrary to the expectations of most gas-industry personnel and government regulators during the 1970s, gas sales have topped out in most regions of the country at or below the price of an energy-equivalent amount of residual oil. The explanation is the fact that **the marginal gas consumer in the United States is a large industrial plant or an electric utility which burns it as boiler fuel.**

More than half of U.S. gas sales in 1982 were to electric utilities and industry, and at least one quarter of the gas sold was burned in large industrial or electric-utility boilers. Thanks in part to the curtailments of the Seventies, many of those consumers now have the capacity to substitute an alternate fuel when it is cheaper than gas. In the most critical market sector, that substitute is residual fuel oil, coal, or some kind of waste product --- not the more expensive No. 2 distillate oil that competes with gas for home-heating sales.

Thus, unless and until "premium" gas consumers actually bid the entire present supply away from boilers and other "low-priority" bulk-fuels uses, **no pipeline or gas distributor can justify buying gas at any price higher than the energy-equivalent price of residual oil.**

Third, the nearly unanimous gloom that existed until recently about the future supply of conventional domestic gas may be unwarranted.

A pessimism generated by declining reserves throughout the 1970s still infuses many of the gas-supply projections published in 1982 and 1983 by government agencies, trade associations, and forecasting institutions. The annual additions to proved reserves of conventional gas in the Lower 48 have in fact been climbing steadily since 1978, however. The forecasters have thus far given little weight to this trend, but have instead preferred to focus on the declining volume of new gas reserves added per foot of drilling in new wells.

In 1981 and 1982, annual reserve additions matched or exceeded the year's production for the first time since 1967, reflecting both an increase in discoveries and a fall in consumption. The gas-producing industry compiled this record despite the existence of "partial" deregulation under NGPA, which diverted exploration effort away from the geologically most promising targets (where gas prices are still regulated) toward high-cost categories of gas that Congress exempted from price controls.

> **Fourth, Canada and Mexico now support huge gas surpluses (relative to any prospective U.S. supply deficiency), and their prospects for new finds are even brighter than in the United States.**

Because of domestic political inertia and the remnants of 1970s-style thinking about gas markets, both the Canadian and Mexican governments are still demanding export prices higher than the market value of new gas in the United States.

Both Canada and Mexico, however, have a pressing fiscal need to find some formula that would make growing volumes of their gas economically acceptable in U.S. markets.

> **Fifth, the degree of market-clearing that these forces have already achieved deprives "rolled-in pricing" of any future value as a tool for marketing gas priced above its market value.**

There is no longer a "cushion" of cheap gas that can offset the high prices of imported gas, Alaska gas, or other "supplemental" supplies. More precisely, the cushion has already been "spoken for" in the prices of exempt domestic gas, the ceiling-price escalation schedules in the NGPA, existing import commitments, and in the expansion of transmission-company and gas-distributor rate bases.

Most pipeline companies have now recognized this reality, albeit reluctantly, and henceforth new gas supplies will be unsaleable at prices exceeding those which they could command in the market if they had to stand alone. Indeed, until the gas-transmission companies have worked or negotiated their way out of the excess volumes of gas they have already bought at above-market prices, **the only gas they can afford to buy will be gas that is priced substantially lower than its value to the pipeline's most reluctant customer**.

> **Sixth, in a market where gas sales are constrained by demand rather than by supply, gas-supply project financing can not depend for debt-security on "consumer-guarantees" --- contracts signed by "downstream" pipelines or gas distributors.**

In the 1970s (and even in the debate over the 1981 ANGTS "waiver package"), "consumer guarantees" were seen mainly as an issue of equity and, once the fairness of consumer risk-taking was accepted, "perfect tracking" (the ability of upstream sellers to recover their costs, dollar-for-dollar, from final consumers without any second-guessing by downstream regulatory bodies) was regarded mainly as a technical legal issue. Both concepts, however, lose all meaning in a *de facto* deregulated market, regardless of their apparent legal force.

The only revenues a gas company can realistically commit in any contract with upstream suppliers are revenues which it can unquestionably collect from its own customers. Thus, market-clearing and exhaustion of the old-gas subsidy cushion mean that minimum-bill and take-or-pay contracts by pipelines or distributors are no longer effective "consumer-payment" guarantees, no matter how perfect the "tracking" of these obligations to subsequent buyers may be in a legal sense.

Seventh, the weakness of "consumer guarantees" effectively means the end of whatever slim prospect may have existed in the 1970s for "non-recourse project financing".

We take up the myth of consumer-guaranteed project financing (and its recent demise) in greater detail below, in connection with the strategic errors in the ANGTS concept.

Finally, the circumstances that cast doubt on the existence of a Lower-48 market for North Slope gas have close counterparts in other major energy-importing regions, including East Asia. The Japanese market for LNG, in particular. has become a buyers' market.

B. The Downturn in World Oil Prices

The NGPA made inevitable the gas-market developments that we reviewed earlier in this report. The revolution in market structure and behavior that accompanies *de facto* deregulation would, indeed, have appeared well **before 1982** but for the second OPEC oil-price upheaval in 1979, which temporarily widened the price advantage of gas relative to oil-based fuels. A decline in real constant-dollar oil prices began in 1981, however, and is now helping to speed up the convergence of gas and oil prices and thus the emergence of a wholly new kind of gas market. The events that most industry and government analysts had expected to occur **after 1985** were moved up even further by the general economic depression and continuing progress in energy conservation, which have combined to shrink the sales of all energy commodities.

Not long ago, almost all the well-known energy-industry, governmental and private forecasting institutions predicted or assumed that constant-dollar crude-oil prices would continue to rise at least through the rest of this century. Large actual price rises in 1979, coupled with faith in ever-rising future oil prices also buttressed the economic credibility of ANGTS, even in the face of rising costruction-cost estimates which seemed to indicate that the delivered price of Alaska gas might exceed its **current** market value (assumed to be the price of **distillate oil**, we must add) during the first few years of operation.

It is remarkable now to look back on some of those old oil-price assumptions. The most recent published gas-market analysis for the ANGTS sponsors is a July 1981 report by Jensen Associates, Inc. ("The Demand for Alaskan Natural Gas"). Jensen's favorable conclusions regarding the marketability of Alaska gas rested on a "least-unlikely" case in which constant-dollar oil prices would increase 8 percent annually over the rest of the century. Jensen's "lower-bound" price case, representing "the lowest level of prices that we think are plausible over the next decade", incorporated a 3-percent growth rate for constant-dollar oil prices.

A splendid illustration of the near-consensus that existed on future oil-price trends in the early 1980s is available in the Resource Planning Associates Inc. (RPA) study of "Net National Economic Benefits of the Alaska Natural Gas Transportation System", prepared for Northwest Alaskan Pipeline Company. In the first quarter of 1981, RPA "interviewed 28 nationally recognized experts on the future of energy prices." **None** of the 28 envisioned a most-likely 1980-dollar oil price less than $42 per barrel ($51 in 1983 dollars) in the year 2000, and the **median** estimate for that year was $96 per barrel ($116).

It is now apparent that the recent global oil surplus and the present price decline, which are already more than two years old, are quite unlike the "glut" and falling prices that occurred in 1975-78 between the two OPEC price upheavals. By April 1983, average inflation-adjusted price paid for crude oil by U.S. refiners had fallen by more than 25 percent from its peak two years earlier. The real test of industry sentiment regarding the long-term energy outlook is, however,

investment behavior. Almost every synthetic-fuels project in North America has been terminated, while the average market value of oil in the ground (proved reserves) in corporate acquisitions fell by more than half between late 1980 and mid-1982. (See B. F. Picchi, "The Valuation of U.S. Petroleum Reserves: Exploding the Myths." in Salomon Bros. Inc., Stock Research/Industry Analysis. October 15, 1982.)

In our view, the 1981 peak in oil prices is not likely to be surpassed within this decade, or perhaps within the century. The crucial issue for ANGTS today is not whether or not our own oil-market analyses (or those of the forecasting establishment, which still expects an upturn in constant-dollar prices later in this decade) prove correct, but the fact that **nobody is sure anymore**. Oil prices **might** conceivably go up once more, but the near-consensus of a couple years ago that they **will surely** go up is in shambles. In mid-1982, it is difficult to avoid concluding that any investment whose viability **requires** a big increase in energy prices is an unacceptably risky investment.

Without the confidence that oil-price rises will exceed general inflation, none of the North Slope gas-development schemes thus far proposed can command confidence as an economic venture. It is thus unrealistic to expect that tens of billions of dollars can be assembled from private parties to finance the project.

C. Inflation, Interest Rates, and Construction-Cost Estimates

One adverse influence on the economic assessment of ANGTS has been a series of increases in its expected construction cost. Only a few years ago, the ANGTS sponsors and their financial advisors viewed rising design costs and the risks of overruns above design estimates as **financing** rather than **marketability** problems. Today they are obviously both. On this issue, in contrast to several others, however, the future could hold some pleasant surprises. While the combination of the sponsors' most recent cost estimates (1981) with foreseeable gas-market conditions and present and foreseeable interest rates now appears fatal to ANGTS ---

> **(1) We do not regard the prospect of ever-rising constant-dollar construction-cost estimates as a major economic hazard for the project, and**
>
> **(2) The sponsors' construction-cost budgets are more likely to be overstated than understated, particularly when costs are measured against the amount of gas to be transported.** (We take up this issue below in connection with the internal disabilities of ANGTS.)

Macroeconomic Influences. In their April 1982 statement announcing a two-year delay in the ANGTS construction schedule, project sponsors attributed much of the difficulty to high interest rates and inflation. During the October 1981 Congressional hearings on the ANGTS "waiver" package, Northwest Energy Company Chairman John McMillian stated that "The biggest factor that has increased our cost over this period the last four years has been the double digit inflation and high interest costs."

Construction-cost overruns were understandably frequent and large in a period when inflation was accelerating and environmental, safety, and other kinds of regulation were getting more complex and demanding. In periods of above-average real economic growth, moreover, the wages of construction workers have historically tended to rise more rapidly than labor compensation in other industries. Finally, accelerating inflation also meant rising interest rates, which result in higher interim financing costs (in utility parlance, "allowance for funds used during construction" or AFUDC), and thus caused the budgeted cost to increase even faster than the wages of construction labor and the cost of building materials.

Market rates of interest are closely related to current and anticipated inflation rates; together they have had a powerful influence on the economic outlook for ANGTS. **General inflation per se** is generally a neutral factor in project economics, because the availability of capital in nominal dollars and the current-dollar market value of gas can both be expected to increase pari passu with prices generally. Inflation and high interests rates **in combination**, however, have had several specially adverse effects on ANGTS.

General inflation rates rose between issuance of the Presidential Decision in 1977, and 1981, causing a repeated and systematic underestimation of construction costs. In such a climate, in other words, the cost-escalation factors incorporated in design budgets never turned out to be big enough.

Higher rates of inflation (and the anticipation of still higher rates in the future) also brought proportionally higher interest rates as lenders demanded nominal rates that would compensate them for the expected loss in the value of their principal, as well as pay an appropriate "real" return on their investment. If nominal rates rose only enough to offset actual future inflation, they still would would not have affected the constant-dollar price of the project or its fixed costs per unit of gas transported, **as seen over its entire economic life.**

Under any given debt-amortization schedule and any given cost-of-service transportation tariff, however, higher interest rates meant that a larger part of the total "inflation premium" would have been **collected in advance**, thus increasing the real-dollar cost of interest charges incurred during the construction period (AFUDC) and the early years of operation, and diminishing this cost in later years. Such a situation was especially troublesome for a project like ANGTS, whose most severe gas-marketability problems were likely to occur in the first years of operation.

Moreover, nominal pre-tax rates of return to equity had to be increased **more** than proportionally to the expected rate of inflation if investors were to count on receiving any given real after-tax rate of return. The reason is the fact that corporate income taxes are levied on the inflationary part of a corporation's book profits as well as on its real profits. As market rates of return go up, in other words, the federal government's tax share of the real pre-tax profit tends to increase.

Beyond and above all of these factors, however, **real** (inflation-adjusted) interest rates have recently been at or near historical high figures, and a continuation of record federal budget deficits combined with a Federal Reserve policy of fighting inflation by means of tight money is likely to guarantee a continuation of comparatively high real interest rates.

Over the long-term, the constant-dollar yields on high-grade industrial bonds, net of inflation, has tended to be less than 3 percent, and the after-tax real return on corporate equity has tended to be about 6 percent. With these market rates, a project whose capital structure contained one-fourth equity and three-fourths debt would have an average capital cost of 4 percent. This figure contrasts with an average real cost of capital exceeding 7 percent under both the high-inflation/high-interest and low-inflation/low-interest assumptions used by DOE. (Tussing & Barlow, "The Struggle for an Alaska Highway Gas Pipeline: What Went Wrong?", Alaska Review of Business and Economic Conditions, August 1983)

> **The real cost of ANGTS capital implied by the sponsors' financial assumptions, coupled with late-1983 interest and inflation rates, exceeds 13 percent. This is on the order of three times the rates "normally" assumed for long-lived utility and public-works projects.**

As the 1960's and 1970's saw accelerating inflation, construction-cost inflation exceeding general inflation rates, rising nominal (and toward the end of the period) real interest rates, and ever-stricter, more complex, and dilatory regulation, it is not surprising that most people came to believe that big construction-cost overruns would always be the rule rather than the exception in large projects.

In our view, however ---

> **The economic and regulatory forces that generated the enormous construction-cost overruns of the 1970's have largely run their course.**

General inflation has already **decelerated** dramatically since its peak in 1980-81 (meaning that escalation rates built into the present construction-cost estimates for ANGTS will typically be too high rather than too low). Real economic growth rates are likely to be lower than in the 1960's and 1970's, moreover, causing the construction-cost indices to increase less rapidly than general inflation. This trend may ultimately bring lower nominal interest rates as well and, if so, interim-financing costs (AFUDC) will turn out to have been overestimated by an even greater factor than "as-built" costs (direct construction outlays).

Another favorable change in the cost outlook involves an increase in **construction-industry labor productivity**, compared to the experience of the 1970s. More contractors would bid, and would bid lower. They would accept lower profit margins, and would bid closer to their projected costs, knowing they would get equipment and supplies according to specification and on time, and would be able to recruit experienced workers. In such a period, contractors would have to pay less overtime, and would be less subject to delays and cost-escalation resulting from labor disputes.

The impact of environmental and safety regulation on costs and schedules will also tend to be less severe than at present. While we do not anticipate any significant retreat from the **goals** that motivate today's environmental and safety dictates, regulatory **practice** will probably tend to be more sensitive to cost-effectiveness criteria and on balance less dilatory. At any rate, it is almost inconceivable that delays and cost-escalation engendered by these kinds of regulation will continue to **grow** as they did in the last two decades.

The performance of the ANGTS sponsors in completing the "prebuilt" Eastern Leg of ANGTS in the Lower 48 and in southern Canada offers some support for these hypotheses. The Northern Border Pipeline and its Canadian counterpart both came on line in 1982 slightly ahead of schedule and slightly under budget.

Macroeconomic influences in review. What went wrong with ANGTS was clearly attributable in part to high financing charges and the impact of expected inflation on cost overruns and the risk of project abandonment. General economic trends, however, suggest that ---

> **The outlook for ANGTS or a successor project, from the standpoint of construction costs and overrun risks (both sensitive to interest rates and inflation), is likely to improve (or at least not worsen) with time.**

III. WHAT WAS WRONG WITH THE ANGTS STRATEGY?

The upheaval that has occurred in natural-gas markets since 1980 means, effectively, that an Alaska gas-transportation project is either an idea whose time has yet to come or, maybe, one whose time has come and gone. Between 1977 and 1981, we wrote in considerable detail about our judgment that ANGTS was potentially a cost-effective and viable project, **under the generally-held economic assumptions of** that time. In each instance, however, we explained why the project could not be financed in the manner contemplated by its sponsors, and approved by the United States and Canadian governments.

Readers who are interested in pursuing this subject in greater detail should refer to the documents listed under "Background Reading" at the end of this report. For the present purposes, however, it is sufficient to deal briefly with two issues, (1) the notion that the sponsors would be able to borrow for ANGTS on the strength of anticipated project revenues alone, and (2) the strategic and regulatory concepts that have encouraged a substantial inflation of the project's expected capital costs.

A. The Myth of Consumer-Guaranteed Project Financing.

In conventional forms of financing, the equity owners put their own assets on the line, pledging to maintain payments of principal and interest to lenders in the event that anything goes wrong with their project. If the owners' assets are insufficient to back the debt, the money is not forthcoming. The pipeline companies sponsoring ANGTS simply did not have adequate net worth to back the project. Even if they had, existing creditors (and their shareholders) would not have allowed them to put everything at risk for a single venture of this type. For this reason, the sponsors of ANGTS and the other big supplemental-gas projects of the 1970s turned to "non-recourse" forms of "project financing".

The essence of project financing is creation of a new business entity in charge of the project for which the sponsoring companies bear no liability. The new entity has virtually no assets outside of the project itself; hence prospective lenders must be assured that some other creditworthy party will meet the tab for principal and interest payments in the even the project does not generate sufficient revenues.

Project financing is not, however, intended as a means of shifting construction, operating, or marketing risks to the lenders. All such risks must be assumed by some other party or parties at least as firmly as the sponsors would have assumed them in a conventional financing. If the pipeline sponsors **could not** bear the risks of non-completion or a shortfall in revenues during some 25 years of operation (due to supply interruption, plant malfunctions, marketing difficulties, etc.), and if the lenders **would not** bear them, who might be persuaded to do so?

Lenders, particularly the big institutional lenders who are crucial to any billion-dollar project, do not willingly take substantial investment risks. The reason is simple: Unlike most forms of equity capital, debt capital has no avenue for upside gain in the event that things go better than expected. No matter how profitable a venture turns out to be, bondholders are paid a predetermined rate of interest; hence there exists no counterbalance to justify taking risks of downside loss. In 1978, a prominent investment banker made the point to us this way: "Even if the marketability of Alaska gas were a good gamble, that is the sort of thing people **invest** dollars in, not **lend** on."

There are essentially three sources of security for project debt capable of eliminating the need for lender recourse against the sponsors --- guarantees from consumers, guarantees from producers, and guarantees from governments or other third parties. The first source of payment proposed by all of the major supplemental-gas projects conceived in the 1970s was revenue from project customers, obtained under "all-events", "minimum-bill" tariffs approved by federal regulators commit wholesale customers (pipeline and/or gas-distribution companies) to pay the costs of operation and maintenance, interest, and the scheduled repayment of principal --- however high those charges may be, and whether or not the service or product is actually delivered.

Each of the three kinds of supplemental gas projects that emerged during the 1970s used a different combination of guarantees. The LNG projects that were financed successfully (El Paso's import project with regasification facilities in Maryland and Georgia, and Trunkline's project with a terminal in Louisiana) used a partial consumer guarantee in the form of minimum-bill tariffs. Sponsors of the Great Plains Coal Gasification plant got the go-ahead to use the same approach, but they found that it wasn't enough. After years of struggle, the Great Plains project was awarded a $2 billion federal guarantee --- the only one yet for a supplemental-gas project --- and in 1983, even this project is on the brink of abandonment unless it now gets a federal operating subsidy.

Spurred by gas rate increases that seem to have no end, public utility commissions and legislative bodies in consumer states and their Congressional representatives have been looking for ways to lessen the payment obligations of distributors to upstream pipelines. In 1982, Michigan enacted a law that abolished automatic pass-through of gas supply price escalations ("purchased gas adjustment" clauses, or PGA's). PGA's are the cornerstone of perfect tracking, and modified to include transporation costs, they are a cornerstone of the ANGTS project too. Similarly, the Missouri Supreme Court in 1979 banned automatic fuel adjustment charges by electric utilities.

Moreover, the same distributors and state regulatory commissions that had testified in favor of high-cost supplemental-gas projects are now urging federal regulators to stop interstate pipelines from bringing those projects on line. Foremost is the Trunkline LNG project. Trunkline's regasification terminal in Louisiana began receiving LNG from Algeria in the fall of 1982. But in reponse to protests from affected distributors, state regulators, and their Congressional representatives, FERC has at least temporarily prohibited Trunkline LNG and its parent, Panhandle Eastern Pipe Line Company, from passing the added costs through to customers.

Trunkline is not the only LNG project that got into trouble. El Paso Natural Gas Company and its co-sponsors Consolidated, Columbia, and Southern Natural mothballed their tankers and terminals in 1980 after less than two years of intermittent deliveries. The cause of the shutdown was a diplomatic stalemate over the purchase price of the Algerian LNG. Although minimum-bill provisions generally protected project lenders by passing on these scheduled principal and interest payments to consumers, the equity was left exposed. El Paso has already written off a gross loss of over $500 million, and Consolidated is considering a write-off of its own investment.

From the standpoint of perfect tracking, things are no more secure today at the upstream end of the pipeline. Take-or-pay commitments at the wellhead, an accepted fixture of the industry for many years, have come under seige. Faced with an inability to sell all the gas they have agreed to purchase and the unwillingness of many producers to renegotiate minimum-take or price terms in their contracts, several pipelines are claiming that changed market conditions constitute a *force majeure* which justifies their unilateral repudiation of those terms.

Regardless of the ultimate outcome of the current litigation over these claims, take-or-pay and all-events contracts have been fatally damaged as security for the financing of gas-supply projects. **The basic weakness of the so-called consumer guarantees is the fact that final consumers are not a party to them.** A tight and unbroken chain of contracts and commission rulings can legally bind pipelines to pay project charges come-hell-or-high-water, and legally bind distribution companies to pay pipeline charges come-hell-or-high water. If the gas is too costly, however, **retail** consumers have no obligation to buy it. If the sales revenues are not there, the gas-distributors can not and will not pay for the gas, contracts and FERC-approved tariffs be damned. And if the pipelines, in turn, can not raise the revenue from their customers, parties further upstream have no guarantee at all.

At bottom, the net worth of the sponsoring companies, which was insufficient to backstop the project's debt-service per se, turns out to be just as inadequate as a fallback source of payments to cover the price of unmarketable gas. What all this means is that **consumer guarantees are dead** once the old-gas cushion is gone, and gone it now is. In 1977, Northwest Chairman John McMillian told the authors that "There can never be a marketability problem. Once the pipelines sign contracts with the Alaska producers, the gas will be marketed." It would be hard for anyone to assert this proposition with a straight face in 1983. (The notion that execution of gas-purchase contracts between the North Slope producers and the ANGTS shippers constituted proof of marketability was, in fact, unrealistic from the beginning, because those contracts all contained rather liberal "market-out" clauses.)

It is clear today, in any event, that the most legally secure contract provision may not be sacrosanct if it proves to have unforeseen but unacceptable economic consequences. Not only will market conditions prevent some purchasers from meeting their commitments, but political and regulatory arrangements are likely to change so as to prohibit their doing so. With respect to ANGTS in particular, the late Senator Jackson, an advocate of the waiver package, attempted to assuage the fears of consumer-state senators by stating:

> "Second, I want to stress that the waiver package does not mean that potential Alaska gas purchasers would be locked into paying the tariff forever if the project were not completed. It simply means that FERC could not act to change the minimum bill tariff in the manner that would impair payment of the debt, taxes, and operating expenses. **I have no doubt that a future Congress would take appro-**

> **priate action if it appeared likely that the project would not be completed."** (emphasis added)

These comments should be seen in the context of the imminent financial collapse of the Washington Public Power Supply System (WPPSS), which was building five nuclear generating plants in the Senator's state. In 1982 and 1983, state courts in Oregon and Washington did indeed free the participating municipal utilities and public utility districts from the obligation to pay their contractual share of the debt service on $2.25 billion in WPPSS bonds, finding that the utilities had exceeded their authority when they signed contracts obliging them to service the debt if no power was produced. The reality of a WPPSS default is fostering a new (and overdue) skepticism about the amount of security that take-or-pay, hell-or-high-water, or all-events contracts really provide lenders. Together with the wave of unilateral contract repudiations in the gas industry, the WPPSS fiasco has left lending institutions with long-lasting suspicions regarding the will and ability of utilities --- even where they are governmental entities --- to make good on their financial commitments in the face of economic adversity.

In 1983, it is almost unthinkable non-recourse financing, secured by only consumer guarantees, can be a viable option for ANGTS or any other North Slope gas-transportation scheme. In the immediately foreseeable future, moreover, there seems to be little prospect that the federal government will provide the additional backing required by such financing. This judgment flows both from the questionable economics of ANGTS today and from the past assurances of the project's leaders that they would not need or ask for direct federal assistance.

B. Unrealistic Promises About Financing

Five years ago, the notion that a transportation system for Alaska natural gas could meet conventional market and cost-benefit tests was not terribly controversial. But it was also generally believed that financing such a system would require extraordinary measures to shift construction and operating risks to consumers, the federal government, or both. The two original applicants before the Federal Power Commission (Arctic Gas, a group that contained most of the present ANGTS sponsors, but under different leadership, and El Paso Alaska) held that in addition to (1) rolled-in pricing, financing for an Alaska gas-transportation system would require an (2) "all-events full-cost-of-service tariff" and (3) federal loan guarantees.

The third competitor, the Alcan Pipeline group (whose U.S. sponsor was Northwest Energy Company, parent company of Northwest Pipeline) asked for neither an all-events tariff nor government backstopping. Northwest's contention that such assistance was unnecessary was plausible because the Alcan plan was probably less risky than its rivals. In its original form at least, the Alaska Highway project offered the smallest capital outlay among the three proposals. It would be built alongside an existing pipeline and highway, using conventional technology and conventional construction methods. Northwest's Canadian collaborators (the Foothills group, composed of Westcoast Transmission Company and the Alberta Gas Trunk Line Company) had experience in building gas pipelines through rugged mountains, muskeg, and permafrost --- almost always completing them on time and within budget. And the project was relatively immune from controversy over Native land claims, environmental impacts, or safety.

In essence, the Alcan group distinguished itself from the other two applicants by its willingness to explore ways for reducing the uncertainties and risks, rather than simply loading those risks onto consumers and the government. Unfortunately, that willingness to strive for non-consumer and non-government risk-taking became a promise of achievement. In his 1977 Decision and Report to Congress, President Carter stated:

> "The Alcan sponsors and their financial advisors have stated the Alcan project can be privately financed. . . Novel regulatory schemes to shift this project's risks from the private sector to consumers are found to be neither necessary nor desirable. **Federal financing assistance is also found to be neither necessary or desirable, and any such approach is herewith explicitly rejected.**" (emphasis added)

Consumer guarantees. The first crack in the proscription of consumer or government support was achieved four years before Congress lifted its 1977 ban on any management role for the gas producers, in the provision of the Natural Gas Policy Act of 1978 that permitted the ANGTS shippers to sell gas on a "rolled-in" basis. However the Congressional Conference Report pointedly warned: "Rolled-in pricing is the only Federal subsidy, of any type, direct or indirect, to be provided for the pipeline." The following year, Northwest's management persuaded the State of Alaska to set up machinery to issue tax-exempt revenue bonds for ANGTS, but never actively pushed the Internal Revenue Code amendments that would have been necessary to the scheme.

It was more than two years later, in the 1981 "waiver package", before the ANGTS sponsors were to ask for or achieve Congressional concurrence in regulatory tactics that were unabashedly "consumer guarantees". It was thus not until 1982 that ANGTS was granted essentially the same level of consumer support that its two LNG predecessors had been awarded in the mid-1970's. And ANGTS has not yet gone after the kind of federal loan support that investors in the much smaller Great Plains coal gasification plant had consistently maintained as essential to its financing (and which they actually received only a few months before the "waiver" hearings).

The conclusion that consumer guarantees alone would not be sufficient to assure financing is not new, and it does not depend wholly on the recent upheaval in natural-gas markets. The Arctic Gas group and El Paso Alaska, which lost out to Northwest Pipeline in the 1977 contest for government approval to build ANGTS, held that a successful financing would require perfect-tracking, a full-cost-of-service all-events tariff (which would impose project costs on consumers even if it never became operational) **plus** federal loan guarantees. In our 1978 studies for the Alaska Legislature, we could not find any knowledgeable person in the gas-producing or gas-transmission industries, investment banking, or the major institutional lenders (outside of Northwest Energy Company and its principal financial advisor Loeb Rhoades) who claimed to believe that ANGTS **construction** could be financed solely on the strength of gas-purchase contracts and pipeline tariffs.

The revolution in U.S. natural-gas markets means that gas-purchase commitments are henceforth virtually worthless as security even for the pipeline's **operational-phase** financing, **unless they are backstopped by the net worth of the sponsoring companies.** By mid-1981, the ANGTS sponsors' own financial advisors were stating publicly that non-recourse financing was out of the question. (See United States Senate, Committee on Energy and Natural Resources, Hearings: The President's Alaska Natural Gas Transportation Act Waiver Recommendation, October 22, 23, and 26, 1981, pp. 454-601.)

The effectiveness of a consumer guarantee, after all, depends entirely upon the existence of regulatory practices and contractual terms that "track" all project costs through to the final consumer with absolute certainty. "Perfect tracking" has, however, already been put to the test with respect to lesser projects --- and it has frequently failed.

The ban on gas-producer equity participation. The 1977 Presidential Decision approved by Congress also barred the North Slope gas producers from equity ownership or any management role in ANGTS. This move stemmed mainly from the long-standing antagonism by the Anti-Trust Division of the Justice Department (which had little knowledge of the gas-transmission business) to shipper-ownership of oil pipelines, but the ban was strongly endorsed by Northwest, whose management feared that the producers' greater financial strength would ultimately give them total control of the project.

The Decision and subsequent pronouncements of the pipeline sponsors and the Carter Administration identified Arco, Exxon, and Sohio (along with the state of Alaska) as "beneficiaries" of the project who were expected to give it financial backing of some kind. For more than three years after the Decision, however, neither Northwest nor the government spelled out exactly what they expected from the producers or Alaska in the way of support. This ambiguity was made necessary in part by the official position of Northwest --- that the pipeline could be financed on a totally non-recourse basis without external guarantees, because non-completion risk and market risk were both "myths", according to Mark Millard of Loeb Rhoades Hornblower, Northwest's most prominent financial advisor.

Millard insisted that an "overrun pool" would satisfy the lenders' concerns about project completion, while gas-purchase contracts were all the security lenders would demand in the pipeline's operational phase. In our 1978-79 inquiry on ANGTS financing for the Alaska Legislature, we could not find any knowledgeable party outside of Northwest, Loeb Rhoades, the White House, and the U.S. Department of Energy admitted taking this theory or Northwest's official financing strategy seriously, or and there was widespread skepticism whether even John McMillian believed his own professions about financing strategy.

The most common view in Congress was that Northwest's "hidden agenda" was to place the federal government in a position where it could not deny financial aid. The producers, however, believed that both Northwest and the federal government (the White House and Secretary Schlesinger) were, by implication, innuendo, and threat, offering them and the state of Alaska a "deal". In return for an assurance of receiving the ceiling price established in NGPA, which was likely to be substantially in excess of the market value of North Slope gas, the producers and the state of Alaska were expected to guarantee the project's debt. In our view, this latter was probably the more accurate speculation.

While the producers would have been delighted by a guarantee of wellhead prices above market value, they made it clear that they had no intention of contributing (or guaranteeing) debt for a project in which they had no management voice. Since ANGTS needed all the financial support it could muster, Congress agreed in early 1982 to a "waiver" of the prohibition on producer equity participation. The producers won the support of Northwest for a provision (in our view, a meaningless one) in the legislation that incorporated the conditioning plant into ANGTS, meaning that the producers would not be required to absorb conditioning costs out of their NGPA ceiling price. The producers in turn made a collective commitment to put up 30 percent of the equity and back 30 percent of the project debt, up to a project total of $30 billion for the Alaska segment and the conditioning plant.

This commitment would have been too little, too late, and surrounded by too many conditions, even if gas markets were not already collapsing, and with them the national enthusiasm for costly supplemental-gas projects. The necessity of heavy producer involvement in the planning and financing of any project had nevertheless become undeniable. In any ANGTS revival or successor project, the producers must be the principal de facto sponsors and put forth the chief effort to bring it about. Clearly, however, understand the economic improbability of the venture right now, and none of them is devoting much effort toward developing a new financing strategy.

One word is warranted on a persistent misconception about the North Slope producers' interest in gas sales. Prolonged reinjection of gas into the Prudhoe Bay reservoir will gradually increase the cost of oil recovery (as more wells must be drilled to accomodate the increasing volume of gas lifted with each barrel of oil). It will neither damage the crude-oil-producing potential of the reservoir, however, nor will it impose serious economic limits on crude-oil production. Thus, the producers will probably be in no hurry to make big changes or big new outlays of money.

C. Incentives for Cost-Expansion

A substantial part of the increase in expected ANGTS costs beyond the original Alcan estimates had a physical (or engineering) origin, as opposed to the "macroeconomic" factors described above: The ANGTS sponsors repeatedly increased their estimates of the amount of labor, materials, and other real inputs to the project. It is difficult to determine precisely, however, how much (if any) of the real cost increase was inescapable, and how much was due to peculiar incentives created by the regulatory system. Nevertheless, several elements in the sponsors' concept of ANGTS have undoubtedly combined with its legal and regulatory framework to vitiate the sponsors' cost-control incentives, or even to create positive incentives for overbuilding and goldplating.

The cost-plus concept. The perception that sponsors and governments held in 1977 regarding gas-market dynamics (1) incorporated an exaggerated notion of the the value of incremental gas supplies and, at the same time, (2) assumed that pipelines and gas-distributors would always be able to "roll in" the prices of Alaska gas and other costly "supplemental" gas with that of "old" price-regulated gas from the Lower 48. This perception, that the demand for Alaska gas was virtually "inelastic" with respect to its price, led owners and regulators to view project economics in cost-plus terms, under which higher capital costs could be "tracked" perfectly downstream to ultimate consumers without jeopardizing the project's viability.

It is a well-established principle of public-utility economics that the combination of inelastic demand (or the belief that demand is inelastic) plus a rule under which allowed profits are proportional to an investment "rate base", creates an incentive for overbuilding and fosters the general tendency of regulated companies to choose relatively capital-intensive technologies and designs (the "Averich-Johnson" or "A-J" effect).

This cost-plus mentality joined with the highly politicized process by which the United States and Canada selected the sponsors and system configuration to encourage everybody to treat the project as a big Christmas party. In the interest of buying support and buying off potential opposition, the sponsors and their allied in government rushed to embrace, indeed to anticipate, every demand of special interest or ideological groups --- inflated union wage scales and employment guarantees; redundant or questionably cost-effective environmental-protection and safety measures; local-hire, Native-hire, minority-hire, and minority-contracting rules; local access to gas supplies; domestic materials content; and much more.

Insistence on solving all engineering issues in advance. The cost-plus mentality underpinned another expensive principle which Congress, the federal courts, FERC, and U.S. custom have recently imposed on large, politically conspicuous public-works projects: the insistence that project sponsors resolve all locational, design, engineering, construction-method, and operational features in detail prior to final certification and commencement of construction. The authorities demanded, for example, that the problem of frost-heave be "solved" in advance with total certainty, even if reaching that "solution" prior to beginning construction, even on those pipeline segments where the frost-heave danger was negligible or non-existent might add billions of dollars to the "as-built" costs and require months of additional research and engineering effort relative to a "down-and-dirty" approach which accepts the necessity of occasional (but less dilatory or costly) repair or reconstruction jobs after project completion.

It is only fair to point out that the original application of the Foothills group proposed a "fast-track" mode of design and construction for the Canadian segments of ANGTS. In his February 1977 Preliminary Decision favoring the Arctic Gas application, however, the Federal Power Commission's Administrative Law Judge Nahum Litt so vehemently rejected both the philosophy and the details of this proposal that Foothills backed off and acceded to the preference of U.S. regulatory institutions for solving every real or imagined problem in advance and in mind-boggling detail.

Real costs and the "Incentive Rate of Return". Another feature of the regulatory regime for ANGTS that has probably contributed materially to the inflation of its construction budget has, ironically, been the "Incentive Rate of Return" (IROR) which the President and Congress imposed on the project expressly in order to counter the tendencies toward cost inflation described here. In a 1977 report, Professor Walter Mead proposed the IROR as a way to "smoke out" the true costs of an Alaska gas pipeline in the face of the incentives competing applicants had to make their proposals more attractive by understating project costs. (W.J. Mead, Transporting Natural Gas From the Arctic: The Alternative Systems, American Enterprise Institute, 1977.) Instead of allowing the sponsors a fixed percentage return on investment regardless of the project's ultimate cost, Mead proposed a rate-of-return rule that would adjust the owners' profit in order to reward them for coming in under budget and penalize them for cost overruns. The argument for this concept was evidently persuasive, and President Carter mandated an incentive rate of return in his 1977 Decision.

In practice, however, the net effect of the IROR on construction costs were probably perverse. In conformity with the purpose of the scheme, FERC at first tried to use the cost estimates in Alcan's original application as the base-cost figure for calculating the IROR. Ultimately, however, the Commission acceeded to the sponsors' demand that the IROR be based on the "final" design-cost estimate approved by FERC. Under this rule, one obvious effect of the IROR was to reward the owners once for overdesigning the project, and once again for reducing actual costs below budgeted costs.

Those federal officials responsible for incorporating the IROR into the President's Decision were initially unaware of the many unsuccessful attempts in the Defense Department to devise an effective cost-control incentive system, some of which closely resembled the IROR ultimately devised for ANGTS. Shortly after Congress ratified the Decision, however FERC staff consulted with senior RAND Corporation personnel who had been involved in the DOD experiments. RAND not only gave FERC advance warning of virtually every variety of "gamesmanship" into which the IROR would draw the sponsors and the Commission but, regarding FERC's task as hopeless, declined even to serve as consultants on designing a specific IROR mechanism.

The IROR not only added greater force to the incentives regulated utilities normally have to overbuild their capital plant, but may have contributed several months of delay (with its attendant costs in AFUDC) to the project schedule, as FERC and the various parties wrestled with a completely untested (and, in our view, an ultimately unworkable) set of procedures, and with one another in selecting parameters for the IROR.

Regulation and ANGTS costs in retrospect. No one can assign credible, specific dollar figures for the total overbuilding, redundancy, and waste contained in the sponsors' most recent cost projections, or the degree to which the IROR and other specific features of the regulatory regime encouraged (or failed to discourage) cost-expansion. The perverse incentives created by the cost-plus logic of public-utility planning, the political and regulatory imperative to solve every real or imagined engineering problem in advance, the Christmas-tree syndrome, and particularly the IROR, have led potential lenders (and even some ANGTS sponsors) to believe that these incentives played a major part in the design-cost escalation since 1977.

Officials of one participating gas transmission company regularly reaffirmed to the authors their belief that their own engineering department could have designed and built the Alaska pipeline segment for as little as 60 percent of its recent budget, and that the cost of the remaining unbuilt Canadian portion could be reduced about 30 percent by returning to the original 1976 "Alcan" concept, which was intended to save money by maximizing the use of existing pipeline segments in Alberta and British Columbia, as opposed to the plan adopted in 1977 for a brand-new "express line" through Canada.

According to a senior engineer in another organization involved in the project, the ANGTS sponsors never seriously considered certain promising low-cost construction alternatives, for example, an on-the-ground berm-covered pipeline (used in the permafrost zones of the U.S.S.R.) rather than a buried pipeline, or fully automated welding. Fluor Corp. on behalf of Northwest Alaskan projected a "lay rate" of only 32 joints per day. In a 1981 critique of ANGTS cost estimates for

FERC, Williams Brothers (which, ironically, is now the nominal project leader) projected a "perfect-day" lay rate of 67 joints and an "average-day" lay rate of 40 joints. Canadian sponsors of ANGTS, however, recently completed several hundred kilometres of 48-inch pipeline in which they achieved daily lay rates of up to 130 joints. With proper planning and semi-automatic welding, international experience suggests that pipelaying and welding of an on-the-ground pipeline could be completed in perhaps one-third of the time contemplated by ANGTS. By the same logic, it should be possible to complete even a buried pipeline in about half the time projected in the sponsor plans.

The prospect for cost-saving redesign. The revolution in gas-market structure and behavior described elsewhere in this report would dictate major changes in the marketing and financing strategy for ANGTS **regardless of anticipated construction costs or their relationship to the long-term market value of Alaska gas**. These changes would, in turn, require a different project organization and a different legal and regulatory framework. An opportunity exists, moreover, to reduce ANGTS capital costs per unit of gas carried by redesigning the system for a larger throughput. Given these requirements, any attempt to save or resurrect the Alaska gas project ought to involve a reconsideration of the existing configuration and design, and of the institutional forces that led to its selection.

Perhaps the best way to vanquish the incentives favoring cost-inflation created by utility-style regulation would be to deregulate the entire system, from wellhead to city-gate.

In either a reorganization or redesign of the project, the most effective incentive for cost-control in both the **design and construction** phases would probably be the approach proposed by the New York Public Service Commission in the 1976 Federal Power Commission proceeding to select a pipeline route and sponsor: Decontrol both the wellhead price of Alaska gas and the rate of return to pipeline equity. Under those circumstances, the cost of overbuilding, gold-plating, waste, bad management, or bad judgment would fall directly on the sponsors, who would also reap any rewards for economy and good judgment.

IV. FOURTEEN RULES FOR A VIABLE PROJECT

The existing ANGTS concept and organization have been battered by (a) a revolution in gas-market structure and behavior, (b) a loss of confidence by industry and potential lenders that real crude-oil prices are certain to resume their upward course, (c) inflation and high interest rates, and (d) changed perceptions of "need" for the project. These developments may be fatal to the concept of a pipeline across Canada for Alaska natural gas or, indeed, to any of the alternatives proposed for the development of North Slope gas. It is useful, however, to consider what would be necessary to make a gas-transportation project viable.

Even if the underlying economics of the ANGTS concept remained sound, radical changes would be necessary in the project's organization and contemplated financing and marketing strategy. In our view, any successful project will have to conform to the following rules:

1. Because the old-gas "cushion" is gone or nearly so, North Slope natural gas **must be marketable on its own** in Lower-48 markets. If the project must depend on any implicit subsidy via rolled-in pricing it is not viable.

2. North Slope gas must have a competitive delivered price **in every year of its economic life.** The exhaustion of the old-gas cushion means that a conventional front-end-loaded rate design (reflec-

ting straight-line amortization of debt and equity capital) would be unworkable for ANGTS.

3. Because the marginal gas consumer in the United States (and in East Asia, as well) uses gas as a boiler fuel, and has the option of substituting some other fuel, the value of North Slope gas in Lower-48 (or Japanese and Korean) markets will be no higher than the price of the boiler fuel it displaces.

4. Regardless of how little new natural gas may be discovered and produced in the Lower-48, and regardless of the volumes of gas that may be imported from Canada and Mexico, the marginal consumer of gas in the United States will remain a boiler-fuel user for the rest of this century.

   Regardless of the gas-supply outlook, therefore, the wholesale (wellhead or border) price of gas will **not** reflect the price of distillate fuel oil (much less that of electricity) or even some average of distillate and residual-oil prices. The volume of imported and domestic gas supplied will, however, determine **what** boiler fuel determines the market value of natural gas --- i.e., whether gas competes at the margin with low-sulfur residual oil, high-sulfur residual oil, or coal.

5. It is impossible to count on a resumption of increases in constant-dollar oil prices. Indeed, no large-scale energy project is a prudent investment unless it would remain competitive under constant-dollar oil prices considerably **lower** than those that prevail today. (For the reasons we expect constant-dollar oil prices to be considerably lower than those of 1980-82, see A. R. Tussing, "An OPEC Obituary", The Public Interest, Winter 1983.)

6. These principles together imply that ---

(a) ANGTS is not a viable enterprise if the absolutely irreducible costs of Alaska gas delivered into the existing North American gas-transportation network exceed $3.00 per mmbtu (1983 dollars);

(b) ANGTS faces an insuperable marketability hurdle if those costs exceed $3.00 in any year of its economic life, and

(c) ANGTS is too risky to be financed without direct governmental guarantees and/or subsidies, unless the average cost of Alaska gas is expected to be comfortably **less** than $3.00 per mmbtu.

7. Because the average retail price of gas will henceforth be a market-clearing price, regulated gas companies will be unable to guarantee payments for expensive gas. **"Consumer guarantees" and "perfect tracking" are now worthless** as security for financing projects that deliver gas at a cost that may exceed its market value.

8. Because downstream gas purchasers can no longer offer credible "all-events", "minimum-bill", or "take-or-pay" commitments for gas priced above its final market value, **non-recourse project financing is clearly unworkable** as a method of funding supplemental-gas projects.

9. Because final-consumer markets have cleared, there is no longer any way to guarantee the tracking of upstream charges specified in contracts or regulations. Thus, **gas producers will henceforth be "price-takers"** and wellhead prices will be determined on a net-back basis. North Slope gas supplies priced above the value determined by netting out gas-conditioning and transportation costs from prices in Lower-48 boiler-fuel markets will be unsaleable.

10. Any viable organizational and regulatory scheme for **ANGTS must incorporate the netback pricing principle.** The North Slope gas producers and the State of Alaska cannot expect to receive more than the wellhead value of their gas, which is the **residual** after conditioning and transportation costs are netted out of the Lower-48 final-market value.

11. As "price-takers" (residual claimants to the value of North Slope gas), **the gas producers and the State of Alaska have the greatest stake** in construction of ANGTS or a successor system, and especially in optimizing its design and controlling its costs.

12. As "price-takers", the North Slope producers and the State of Alaska must be the **first guarantors** of any debt, at least to the extent of their gas-sales revenues, even if that exposure is not made explicit.

13. If, however, there is a chance that reduction of wellhead revenues to zero might still result in a deficiency in the scheduled principal and interest payments to lenders, then the financeability of ANGTS will depend on an **explicit** dedication of producer and state assets.

14. If the expected "upside" rewards to the producers and the State are not sufficiently large and sufficiently secure to induce them to provide adequate backing for debt, then only a federal guarantee has a reasonable chance of making the project financeable.

V. SYSTEM CHANGES AND ALTERNATIVES

A. Economies of Scale: Reducing Unit Costs by Increasing Gas Deliveries.

The Prudhoe Bay reservoir is obviously not the only potential source of gas in Arctic Alaska. Gas reserves from the Kuparuk and Endicott fields will available for sale by the time any transportation system could be in place, and the prospects of further major gas discoveries in the Mukluk structure and elsewhere in the vicinity are excellent. The most promising measure for reducing real fixed costs per unit of gas would thus be a redesign of the project to carry more gas from the North Slope than the 2.0 billion cubic feet per day (bcf/d) contemplated by the sponsors and assumed in their cost calculations.

A common rule-of-thumb for petroleum-industry pipelines and process vessels states that capital costs tend to increase with the six-tenths power of capacity. (See A. R. Tussing and L. S. Kramer, Hydrocarbons Processing. "Economies of Scale", pp 29-33. Anchorage: University of Alaska, 1981.) The six-tenths-power rule of thumb, however, does not apply to the Alaska segment of ANGTS or to the Northern Canadian segment, because of their relatively high logistical and environmental costs, which would hardly be affected by a doubling of throughput capacity.

The cost of steel, for example, is typically about 45 to 50 percent of the cost of pipeline construction in the Lower 48, but only about 5 percent of the projected costs for the Alaska segment of ANGTS. Doubling throughput (either with a larger-diameter pipe or with higher operating pressures) would probably require less than twice the original amount of steel. Thus, a doubling of capacity which would add (say) 40 percent to the cost of a Lower-48 project in steel costs alone, would add less than 5 percent in Alaska.

Economies of scale are therefore far more influential on ANGTS than they are on most gas-pipeline projects, and a doubling of capacity would be unlikely to add more than 20 percent to the overall capital cost --- the result would therefore be a 40 percent reduction in fixed costs per unit. (1.2/2 = .6) Thus, increasing pipeline throughput to accomodate additional North Slope production appears to be offer an important opportunity to improve the economics of ANGTS. Conversely, **reducing** the throughput, as proposed by the Yukon Pacific group would result in a sharp **increase** in fixed costs per unit, and would further undermine the project's economic viability. Assuming a capital cost increase of 20 percent, and a throughput of 4.0 bcf per day, yields the following changes in the fixed capital cost per unit, relative to the most recent official ANGTS budget.

B. LNG Exports

A committee co-chaired by former Alaska governors Egan and Hickel recently took a fresh look at the concept of an "All-Alaska" pipeline, combined with an LNG terminal in Southcentral Alaska, for marketing the North Slope gas. This approach was first promoted in the mid-Seventies by El Paso Natural Gas Company (and vigorously supported by both of the former governors) but rejected by President Carter and the Congress in 1977 in favor of the Alaska Highway route. Not surprisingly, when the committee released its findings in January 1983, it found such a system to be economically feasible, under its chosen assumptions about world oil prices, engineering costs, and competitive factors. (The Governor's Economic Committee, Trans-Alaska Gas System: Economics of an Alternative for North Slope Gas, January 1983) This proposal is the progenitor of the present Yukon Pacific scheme.

TAGS would have almost exactly the same pipeline mileage in Alaska as ANGTS, through the same or more difficult terrain and would, in addition, require a liquefaction facility on Cook Inlet whose cost would exceed that of the entire unbuilt portion of ANGTS in Canada. The TAGS plan would spend less on a North Slope gas-conditioning plant but would, of course, need a fleet of LNG tankers to deliver the product to the Far East. The preliminary engineering study of the committee's "Trans Alaska Gas System" (TAGS) by Brown and Root purported to show considerably lower total capital costs than in the most recent ANGTS budget. There are significant differences in design, but they are not differences that stem from the different market destinations or the differences in system configuration. Because the ANGTS sponsors' budget it quite specific, but likely inflated, while the Brown & Root cost estimates for TAGS are only conceptual, there is little ground for assuming the latter would in fact be cheaper.

The governors' report found, more importantly, that "North Slope gas does not have a ready market in the United States in the near term." Consequently, the most crucial difference between and both ANGTS and the earlier El Paso LNG plan is its targeted market: The TAGS promoters envision exporting LNG to Japan. Unfortunately, even from this point of view TAGS, like ANGTS, appears to be a proposal whose time has already passed, along with the "seller's market" which characterized all portable energy forms in the 1970s.

Granted, the TAGS concept does not depend upon a cushion of old, regulated Lower-48 natural gas as ANGTS does, and as did the earlier Alaska LNG-import proposals, El Paso and PAC-Alaska (a proposal, shelved in 1982, by two California utilities to move Cook Inlet gas to the West Coast as LNG). The viability of TAGS does, however, depend upon the continuing willingness of Japanese customers to pay crude-oil-equivalent prices for LNG and on a continuing increase in world oil prices at a rate exceeding that of general inflation. Both of these assumptions are, at best, questionable in mid-1983.

C. A Methanol System

Next to revival of the "All-Alaska" gas-pipeline-LNG concept, the ANGTS alternative that has attracted the most attention is the possibility of converting North Slope gas into methanol and moving it as a blend with crude oil or in batches through the existing oil pipeline (TAPS), through a new pipeline, or directly from the North Slope in icebreaking tankers or submarines.

World methanol-producing capacity already exceeds the levels of chemical-industry demand anticipated for at least the next decade. Without the appearance of production-line fleet of alcohol-fueled vehicles and a fuel-supply and service infrastructure, however, the only bulk market for addition of a large new supply of methanol (exceeding, indeed, the entire world's 1980 production) would be as boiler fuel, at boiler-fuel prices. Recent demonstration projects by the California Energy Commission, Ford, Volkswagen of America, and others have shown convincingly that methanol is a satisfactory motor fuel, superior in some respects to gasoline (air quality impacts and engine life, for example), and that mass-produced production vehicles would cost no more than their gasoline-powered equivalents. Even a motor-fuel market would require the **expectation** that delivered methanol prices be significantly less than the price of the same energy in the form of refined petroleum products, however, because only such an expectation would support the installation of production-lines for alcohol-powered vehicles and the necessary fuel-distribution network.

The technical pros and cons of the various transportation variants are complex. Some of them are undoubtedly many years away from technical feasibility --- submarine tankers, for example. Both marine transport schemes would require the devotion of much money and time to research and development efforts that might not pay off, and thus involve large government subsidies which are not now in sight. It is unlikely that TAPS would have the spare transportation capacity to handle the entire Prudhoe Bay gas output in methanol form until the mid-1990s and it is quite conceivable that additional oil discoveries could sustain the present level of crude-oil throughput past the end of the Century.

Alternating batches of crude oil and methanol would require major changes in TAPS equipment and operations, while the blending of methanol with crude oil appears out of the question (because it produces a gummy precipitate). The concept of a separate pipeline to ice-free tidewater for methanol (and perhaps natural-gas liquids) is especially attractive, because such a pipeline would cost much less than TAPS did or ANGTS is expected to cost. The crude-oil pipeline is heated and, for most of its length, elevated, while the gas pipeline would be chilled and buried. Since methanol and NGLs remain liquid under pipeline conditions at any temperature they would encounter in Alaska, however, a methanol-NGLs pipeline could take the form of a relatively inexpensive on-the-ground, ambient-temperature facility.

Almost any of these transportation modes could, arguably, move North Slope gas energy to market at a lower btu/mile cost than a gas pipeline or gas-pipeline-LNG system, **if** it turned out to be technically feasible and **if** all generic research and development costs were ignored (or covered by some kind of government subsidy). What is fatal, however, is the comparison between the total cost of delivering methanol to market (including manufacturing cost, pipeline transportation, and marine transportation) and its market value. There does not seem to be any methanol-conversion technology on the market today whose **fixed capital cost**, even for a prefabricated plant barged to an ice-free tidewater site, would be less than the market value of industrial boiler fuels.

D. The Alternatives in Perspective

A conventional natural-gas pipeline across Canada, an "all-Alaska" gas-pipeline and LNG delivery system, and conversion to methanol are not the only plausible dispositions for North Slope natural gas. Given a sufficiently distant time horizon, the shipment of LNG by icebreaking tanker or submarine directly from the North Slope, for example, or use for thermally-enhanced recovery of heavy crude oil (which exists in vast quantities on the North Slope), can not be ruled out. Future market and technological developments may well alter the economic ranking of ANGTS, pipeline-LNG, and methanol schemes. Under every option considered so far, however, development and marketing of gas from the Arctic would require an initial investment in the tens of billions of dollars, and have an irreducible fixed capital cost per unit nearly as high as, if not higher than, the value of incremental gas supplies in the Lower 48 or East Asia. Unless investors are convinced that the level of world energy prices (as measured by real world oil prices) is certain to rise far above its 1981 peak and stay there, none of the options we have considered here will be a prudent investment.

In conclusion, we believe that something like ANGTS is still the strongest of the current proposals, but none of them is strong enough today to constitute a serious planning or investment option. It is indeed conceivable that Prudhoe Bay gas will **never** be a marketable commodity. Before it can become such a commodity, the worldwide energy situation, the technological menu, or both will have to change in ways that we cannot now foresee.

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Presented for the Record
Oversight Hearing - November 16, 1983
Marketing Alternatives for Alaska Natural Gas,
U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy Regulation.

November 17, 1983

To The Chairman and Members of the Committee,

Alaska natural gas is one of the major future sources of energy from the U.S. By being a source of energy for this country it is indirectly also a source of energy for the rest of the world when considering the implications resulting from a U.S. decreased dependence on foreign oil, leading to decreased pressure on the global oil market and thus making more oil available for other oil importers. Natural gas could also be a direct source for our allies in the Pacific. All this is clear and was adequately covered in the Hearings.

The issue I would like to raise here in order to enlarge the scope of the search for alternate marketing procedures of the Alaska natural gas is related to the final ways of utilization of the gas. A major question that has to be raised is whether the use of fuel-gas has to follow the restrictive track that was laid out by an oil oriented industrial system? Natural gas - as a motor vehicle fuel - could be used to introduce novel fuel gas and methanol fueled motor vehicle systems. If Compressed Natural Gas (CNG) is the first use of the gas then the construction of a natural gas pipeline from Alaska to the lower 48 States is indeed imperative but if a methanol fuel is going to be used then it would be easier to build the plants to produce the methanol in Alaska. Alaska would then benefit from the establishing of the new industry and the methanol could then be moved by pipeline or by ship. If methanol is the product then facilities for liquefaction of the gas are unneeded in Alaska and the market for the methanol is increased as it could go to ports that do not have LNG facilities. Considering that many other natural gas producers have already established methanol-from-natural gas plants, one can foresee that this will induce the auto-vehicle manufacturers to ready for the m arket the needed methanol engines - at least if not Detroit the Japanese manufacturers will be ready with these engines to take advantage of a budding methanol glut. With methanol fueled motor vehicles in mass production it can be shown that the methanol glut will vanish and an Alaska methanol production would bring in the largest benefits to the State of Alaska. Furthermore, the U.S. economy will gain most from the substitution of oil products by methanol from natural gas as it will thus start establishing the infrastructure that will allow in the long run the use of methanol from coal that will be introduced when the supplies of natural gas start to dwindle.

Members of the Committee my intervention and the above ideas - the need to reconsider the whole issue of Alaska natural gas transportation in the light of a possible methanol economy - are I believe an integral part of the issue before the Committee - the marketing alternatives for Alaska North Slope natural gas.

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November 16, 1983

UNITED STATES SENATE
Energy and Natural Resources Committee
Statement of Lovett C. Peters
Prepared for Meeting of November 16, 1983

METHANOL FOR AUTOMOTIVE FUEL AND FOR STATIONARY POWER PLANTS

The deferral, if not the demise, of the Alaska Natural Gas Transportation System (ANGTS), offers an opportunity to provide an alternate market for the 28 trillion cubic feet of Prudhoe Bay gas reserves.

Understandably, Exxon, Arco, and Sohio, as the dominant owners of this huge gas reserve, want to maximize their return on it. If the ANGTS can be built soon, and if the netback on the gas can be maintained at the levels proposed in the 1978 Natural Gas Policy Act, the transportation of this resource as natural gas overland for ultimate consumption in the lower 48 states is likely to be the best alternate available for the owners of the North Slope gas.

However, this alternative looks very shaky. In the light of that, the conversion of the raw gas directly into methanol on the North Slope appears to be the best available alternative.

This plan envisages the construction of at least 20 barge mounted world scale methanol plants for installation on the North Slope of Alaska during the summers of 1988-1992 (4 each summer.) Each plant would have a capacity of 2500 M tons/day and each 4 plants would require some .3BCF/day in total of gas feedstock. The 12.6% CO_2 content of the North Slope gas and the LPGs (about 12.8%) in the gas stream (except for the pentanes+ which would be put into the crude stream) would all be converted to methanol. Methanol output would be approximately 360,000 barrels a day. Economics would favor a project increased to 500,000 B/D or more if market conditions warranted.

Arco, Exxon, and Sohio are most reluctant to give up any spare capacity in the Alyeska crude line since they feel that sooner or later this excess capacity will be required to move newly discovered North Slope crude to Valdez. Hence, a separate methanol line, perhaps 24" in diameter, paralleling the Alyeska crude line would have to be built in 1988. However, if surplus capacity in the Alyeska line is anticipated at the time the first methanol comes on stream, a study should be made of the feasibility of blending methanol into the crude stream and extracting it when the crude is refined in California or of batching methanol through the line. If this were feasible, it would allow the pipeline to be built a year or two later, when its load factor would be higher.

This project will depend in large measure on the ability of the world market to absorb a major increase in methanol supply.

Since the U. S. methanol market is today only approximately 100,000 B/D, the project will depend on the willingness of existing and potential methanol users and suppliers or other interested parties to underwrite 360,000-500,000 B/D of new methanol production in the 1988-1992 time frame on top of three new world scale methanol plants under construction in the Persian Gulf (coming on stream in the 1983-85 time frame). We believe that the market could well be developed fast enough to absorb this new capacity.

Uses for larger volumes of methanol would center around 1) three methanol applications as motor fuel...the three are a) small amounts blended into gasoline, b) additional amounts converted to MTBE and TBA, which are very high octane components for gasoline upgrading, and c) neat (straight) methanol; 2) stationary power plants (particularly in California); and 3) the use of methanol as the fuel in major fuel cell applications.

1 a) and b) above are being done commercially on a limited scale and all three uses are being very successfully tested in California by Bank of America and the California Energy Commission. Also being tested is the use of methanol in 2-stroke engine diesel busses, which has given very favorable results in early tests.

Chem Systems have estimated U.S. methanol consumption in 1990 at 2.1x 1982 consumption. The World Bank April 1982 study anticipates large increases in methanol consumption around the world.

Both Ford and General Motors are high on neat methanol as an ultimate motor fuel but no one is clear over the timing of the transition to methanol.

Japan is reported to be enthusiastic about methanol as a motor fuel for its use would help alleviate much of Japan's existing smog. Canada is seriously considering mandating a small percentage of a combination of methanol and TBA (a methanol derivative) in its gasoline.

In addition, there is bound to be increasing pressure for an octane improvement in unleaded 87 octane gasoline since the higher octane will allow for higher compression ratios and their better mileage/gallon. More unleaded 91-93 octane gasoline being offered to the public and the trend to more and better unleaded fuel is expected to continue. Methanol derivatives MTBE and TBA, as well as methanol itself, will each improve unleaded gasoline octanes. The ultimate is probably neat methanol which makes possible very high compression ratios without expensive and complicated pollution equipment. The Webster-Heise valve, now undergoing tests, gives promise of overcoming most if not all of the shortcomings heretofor recognized in the use of neat methanol in a "gasoline type" engine.

Davy McKee Corp. (engineers and constructors of many of the world scale methanol plants) has indicated that the 2500 T/D methanol plants on self-contained barges would cost on the order of $300 million each in 1982 dollars, if 20 were committed at one time, or $6 billion for 20 of them. The project should allow $2 billion for a 24" pipeline and $1 billion for storage, shipping facilities and contingencies. At these costs the project economics would translate into methanol at Valdez about as follows:

Capital costs might be in the ranges indicated for 1982 dollars

$millions

Summary	360,000 B/D	500,000 B/D
20 2500 T/D Methanol Plants	6,000	
28 2500 T/D Methanol Plants		8,400
24" Pipeline	2,000	2,000
Storage, shipping facilities, and contingencies	1,000	1,200
TOTAL	9,000	11,600
Onstream factor 330 days/year		
Methanol produced bbls year (million)	118.8	165.0
gals year (million)	4,699	6,930
Operating Costs		
Labor - 85 men/plant at $100,000/man	170	238
Maintenance of Methanol Plants ex labor 2% of plant cost per year	120	168
Catalyst $1 Ton	17	28
Other operating costs	214	237
Pipeline (fuel$^{(A)}$ and operating expenses)	149	200
	670	871
Capital Costs @ 20%	1,800	2,320
Gas Purchase Costs $2 Mcf	1,564	2,190
	4,034	5,351
Methanol Costs at Valdez - $2 gas	86¢	78¢
$1 gas	69¢	62¢
50¢ gas (Saudi gas price)	61¢	54¢

(A) Some of the pipeline fuel will be methanol.

Davy McKee recently set up the staffing patterns for the Mobil New Zealand methanol plant of similar size. This required 85 men for a 2400 T/D plant. The maintenance and catalyst numbers are also from Davy McKee.

There would be substantial savings in having 20 or more identical units - spare parts, inventory, interchangeability of manpower, etc. In addition, all clerical functions would be done via on-line computer at Seattle.

The indicated costs for methanol at Valdez are not attractive when compared to the current depressed U. S. methanol price in the 45¢ a gallon range. In more normal times methanol has sold in the 60-70¢ range. However, turning North Slope gas into methanol appears to offer a better economic opportunity than building the ANGTS at a much higher capital cost and offering gas in the Northern U. S. at prices far above those of other U. S. produced gas. And methanol does have a very attractive future direct as motor fuel or as a motor fuel supplement.

It is now apparent that the U. S. gas utility market is unwilling to pay a price sufficiently high to justify construction of the ANGTS. The creation of a practical market for the gas should represent an enormous economic opportunity for the consortium coming up with the best solution. We believe this represents the best solution! While its time has not come, we believe most of the evidence points to methanol as the ultimate automotive fuel.

North Slope gas producers will have to reach a decision on how to market their gas. Several major factors are involved:

a) All gas is now being reinjected at an increasing cost per barrel of oil produced.

b) If the gas is pipelined to the lower 48, a very expensive ($4-6 billion) gas cleanup plant will be required. This plant is not required under the methanol solution.

c) Some geologists believe that additional North Slope drilling is more likely to discover gas than oil.

Methanol has only about half as many BTUs per gallon as gasoline. Because of certain other favorable attributes, a gallon of methanol on average, probably can displace about 3/4 of a gallon of gasoline. Hence, 500,000 B/D of methanol used as motor fuel might represent a 375,000 B/D addition to the U. S. domestic fuel supply and reduce imports accordingly.

The problem of finding a market for 4-5 times the 1982 U. S. methanol consumption, even if spread out over a five-year period, is a classic chicken and egg problem. The automotive manufacturers will only produce cars using methanol when the market wants them. And the market will not want methanol cars in volume until the fuel is widely available. Hence, if governmental subsidies are indicated to solve the North Slope gas "problem," conversion to methanol appears to be the way to go. Also, methanol from North Slope gas will require considerably less subsidy than methanol from U. S. coal.

John E. Justice, Vice Chairman of Rotan Mosle, Inc. of Houston, concurs in this statement.

CITY OF VALDEZ, ALASKA

Statement for the Senate Subcommittee
On Energy Regulation, Oversight Hearing -
Marketing Alternatives for Alaska Natural Gas,
November 16, 1983,
IN SUPPORT OF THE ALL-ALASKA GAS LINE

PRESENTED BY
CARROLL SUSAN COLLINS, MAYOR
CITY OF VALDEZ, ALASKA

MAYOR'S STATEMENT

On April 4, 1983, Alaskan Governor Sheffield directed a letter to President Reagan which in part stated the following:

> "The State supports any project that can reasonably offer the prospect of bringing Alaska gas to market. This includes our past and present support of the Alaska Natural Gas Transportation System (ANGTS)."

The City of Valdez, Alaska, would like to join Governor Sheffield in supporting the all-Alaska Natural Gas Transportation System and we urge the Congress to consider the economic and social advantages of an all-Alaska natural gas line.

The City of Valdez would also urge the Congress and the State of Alaska to consider an alternative route for the natural gas pipeline. The alternative route would follow the existing trans-Alaska pipeline to tidewater at Valdez.

The City of Valdez offers a wide range of siting advantages for the trans-Alaska gas line terminal.

Briefly outlined, the specific advantages the Port of Valdez offers as a terminal site for the trans-Alaska gas line are:

Industrial Land

The City of Valdez has an Industrial Park of 2,000 acres located in Valdez glacier valley adjacent to the airport and the Richardson Highway;

Shipping

Valdez is the northern-most ice-free port in Alaska and deep water close to shoreline is readily available.

Community Infrastructure

The City of Valdez has the community infrastructure capable of accomodating an additional permanent labor force of 2,500 without serious impacts;

Environmental Problems

No major environmental problems concerning air, water, or natural resources are foreseen;

Community Interest and Support

The community of Valdez actively pursues economic and industrial development and enthusiastically supports the natural gas line terminus in Valdez;

Water Availability

The quality of ground water in Valdez exceeds EPA's standards for drinking water. The supply is plentiful and would provide a great percentage of the site's requirements; and

Tax-exempt Bonding

Valdez has become a leader in the field of tax-exempt industrial development bond financing and stands willing to assist industry desiring to locate in the City.

Summary

The City of Valdez aggressively pursues economic and industrial development. The combination of the City's expertise in tax-exempt bonding, development-oriented comprehensive and coastal management plan, developed city infrastructure, and industrial park can offer prospective industrial development many economic and siting advantages found nowhere else in the State of Alaska.

In further elaboration of Valdez' unique siting advantages for a trans-Alaska gas line terminal, I have enclosed, for the record of the Hearing, the document, "Siting Evaluation for All-Alaska Gas Line Terminus, Valdez, Alaska -- Prepared by the City of Valdez, Alaska, December, 1983." This is introduced by Valdez' City Manager, Jim Watson, for reference to interested oil/energy companies.

CITY OF VALDEZ, ALASKA
PROPOSAL

IN SUPPORT OF THE
ALL-ALASKA GAS LINE

PRESENTED BY
CARROLL SUSAN COLLINS, MAYOR
CITY OF VALDEZ, ALAKSA
NOVEMBER 16, 1983

CITY OF VALDEZ, ALASKA, PROPOSAL
In Support of
ALL-ALASKA GAS LINE

The selection of Valdez as a potential petrochemical site has resulted, to our knowledge, in at least four feasibility studies since 1977. These studies were conducted by three independent consulting firms which were primarily concerned with Valdez as a potential site for a petrochemical refinery and as a tide-water, trans-shipment point for bulk petrochemicals.

The following report summarizes the findings of the four feasibility studies on each of the siting requirements.

Site Location

In 1977, Environmental Services LTD stated that Valdez had poor land (site) availability and that low-lying portions of the potential site could be inundated by land subsidence and seismic sea waves during a major earthquake.

A 1981 Dow-Shell study concluded that Valdez had a 4,290 acre, city-owned industrial park with readily available access to port facilities.

In 1978, a study for Alpetco was also prepared by Brown and Root. In this report Brown and Root described the Valdez Industrial Park as "up to 2,000 acres of combined hillside and flood plain property north of Old Valdez". In their summary Brown and Root stated "the land availability, topography, and economics make this (Valdez) site preferable to any of the other sites considered for the construction of a petrochemical refining complex".
However, in a 1983 report prepared for the Governor's Economic Committee on North Slope Natural Gas, Brown and Root concluded that "no appropriate site was available in Valdez".

The City of Valdez has a DEDICATED industrial park of approximately 3,000 acres. The industrial park is adjacent to the Valdez Airport and has over 4,000 feet of frontage on the Richardson Highway. The industrial park is less than one-half mile from the new container dock with a new access road planned within the next eighteen-month period.

Contrary to the 1977 study by Environmental Services LTD, the industrial park is not threatened by land subsidence or seismic sea waves (Dowl Engineering Hazard's Report, 1983). Because Valdez Glacier Stream bisects the park some flood control measures would be required.

Hydrology

Environmental Services LTD, stated that Valdez's high quality, fresh water was limited but a thorough exploration program would be required.

The Dow-Shell study of 1981 found the quality of groundwater in Valdez exceeds EPA's standards for drinking water and the supply plentiful enough for site requirements.

The 1978 and 1983 studies by Brown and Root failed to discuss the availability of fresh water as part of siting criteria.

Coastal Waters

Environmental Services LTD, found the coastal waters of Valdez an excellent location for large-draft shipping. Sea ice does not occur in Valdez Bay and deep water is available a short distance from most areas of the shore line.

In 1981 the Dow-Shell Group also found Port Valdez an excellent shipping port. Of the six state-wide locations reviewed, Port Valdez appeared to be the preferred dock site.

The 1978 Brown and Root Study stated that Valdez had "good deep-water sites" for port facilities. In 1983, in the report to the Governor's Economic Committee, Brown and Root again supported the advantages of Valdez as a port site because of "deep-water locations close to shoreline; ice-free port year-round; and safe marine approaches make the Port of Valdez a preferable site for petrochemical shipping".

The success of the Alyeska Marine Terminal has proven the outstanding capabilities of Port Valdez as a world class petrochemical shipping port. As to the capability of port expansion, in 1981 the Coast Guard Commander in charge of the tanker navigation in Port Valdez and Prince William Sound stated that the Coast Guard could handle ten times the existing traffic of 2.5 petrochemical tanker passages per day.

Climate

Environmental Services LTD, found that the air quality in Valdez would be affected by the fiord character of the area. The resulting inversions would make the Valdez site unsuitable for large-scale industrial development because of air quality problems.

The Dow-Shell study of 1981 involved extensive air quality monitoring by Dowl Engineers. The conclusions were that the Valdez site could operate a major refinery facility without exceeding national air quality standards and that air inversions would not have the severe impact as previously believed.

The Brown and Root Study of 1978 stated "that environmental concerns (air quality) should not be a major problem. Air monitoring in the Valdez Basin has been maintained constantly since the completion of Alyeska". Brown and Root further concluded that air quality problems could be mitigated through the use of advanced pollution control technology.

In their 1983 report to the Governor's Economic Committee on North Slope Natural Gas, Brown and Root did not consider air quality in their site selection criteria.

Community Infrastructure

Environmental Services LTD, in 1977, described the infrastructure of Valdez as "generally being available" due to pipeline construction.

The Dow-Shell Study did not include infrastructure in the site selection process.

Brown and Root, in the 1978 study for Alpetco, described the infrastructure available in Valdez as excellent for major petrochemical development. The 1983 Brown and Root Study for the Governor's Economic Committee did not consider community infrastructure.

SUMMARY OF COMPARISONS

Environmental Services LTD, in 1977, rated Valdez third out of nine sites. The major favorable characteristics found were; available borrow material, ice-free, deep-water port, local government capabilities to cope with development, developed infrastructure and support services and good transportation services.

This report gave the disadvantages of Valdez as; air quality problems, lack of available flat land and lack of energy generation. Since this study has been concluded it has been shown that adequate flat land does exist and air pollution potential considerably reduced.

The Dow-Shell Group in 1981 did not name preferance in the six sites that were considered. Of the six potential sites Valdez ranked highly in location and land availability, available water, and shipping and port sites.

Brown and Root in 1978 completed a study for the Alpetco Company. In this study twenty-two individual potential sites were examined. Based on the evaluations Valdez was the preferred site for petrocehmical processing and as a shipping site because "adequate land was available, it had no serious environmental problems; it has the complete support of the local community and significant economic advantages over any other acceptable site".

However, in 1983 Brown and Root in a report to the Governor's Economic Committee on North Slope Natural Gas, stated that Valdez had no adequate site (land) and found no other advantages other than a deepwater, ice-free port. No mention was made as to the advantages found in their 1978 study. Brown and Root's conclusion in this report was that Kenai was the only acceptable petrochemical site.

In a 1983 report prepared by the Community Development Department, the City of Valdez cited a wide range of siting advantages for the trans-Alaska Gas Line Terminal.

Briefly outlined, the specific advantages the Port of Valdez offers as a terminal site for the trans-Alaska gas line are:

Industrial Land

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Valdez has become a leader in the field of tax-exempt industrial development bond financing and stands willing to assist industry desiring to locate in the City.

Summary

The City of Valdez agressively pursues economic and industrial development. The combination of the City's expertise in tax-exempt bonding, development-oriented comprehensive and coastal management plan, developed city infrastructure, and industrial park can offer prospective industrial development many economic and siting advantages found nowhere else in the State of Alaska.

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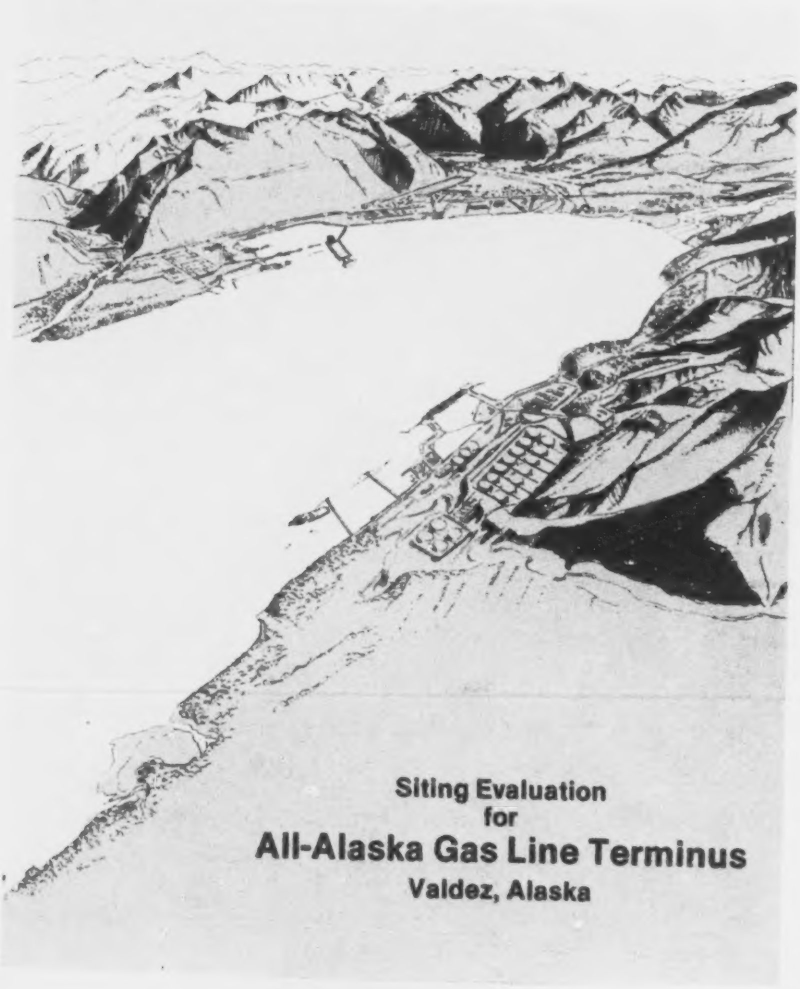

Siting Evaluation
for
All-Alaska Gas Line Terminus
Valdez, Alaska

Prepared by
The City of Valdez, Alaska
December, 1983

City of Valdez

A Gateway to the Interior
Terminus of the Trans-
Alaska Pipeline

OFFICE OF THE CITY MANAGER
December 9, 1983

Prior to submitting the "Trans Alaska Gas System, Economics of an Alternative for North Slope Gas" to the Governor in January, 1983, the Governor's Economic Committee on North Slope Natural Gas selected Brown and Root, Inc. to study alternatives for marketing North Slope natural gas which included siting aspects. Because as a directive, the Governor's Economic Committee was to select a site "emphasizing routing for the lowest capital and operating costs," we feel that Valdez was unjustly excluded from further consideration and strongly believe that Valdez is the logical location for the terminus of an All-Alaska Gas Line.

We feel it necessary to point out at this time that in the report submitted by the Governor's Economic Committee it was acknowledged that "because of limited time and budget available for the study, no original field work or extended reconnaissance work was performed." The report states that "The engineers have reconnoitered by helicopter the pipeline routes to most potential locations and are aware of the features discussed but have not made what would be considered as in-depth studies of any of the several potential locations."

It is because of this the City of Valdez has compiled the information in this book to provide detailed, up-to-date information for purposes of evaluating the Valdez Industrial Park as the logical terminus of the All-Alaska Gas Line. This report is not intended to be exhaustive of all criteria but does cover prominent considerations. The majority of these considerations have been evaluated in past feasibility studies; however, this compilation represents the most recent information available.

Many factors indicate the Valdez Industrial Park is the optimum site for an All-Alaska Gas Line Terminus. Briefly those factors are as follows:

1) A pipeline corridor from the natural gas fields to Valdez is already in place. This includes the geological and soils

P. O. BOX 307 . . . VALDEZ, ALASKA 99686 . . . TELEPHONE (907) 835-4313

analysis being completed, and existing right-of-way and extensive knowledge of the physical terrain and environment which must be duplicated at considerable cost if a new pipeline route is developed.

2) Adequate land area is available, including 1330 acres of Tract B in the Valdez Industrial Park of which 950 acres is cleared and would require little site preparation, and 1600 acres of Tract A in the Valdez Industrial Park. Additionally, the site includes access roads from the Richardson Highway, Airport Road and includes the City's principal tidewater marshalling site and proposed foreign-trade zone area. An existing right-of-way for a product's pipeline already exists from the intersection of the Richardson Highway and Dayville Road to the proposed liquid's loading dock, between Allison Point and Solomon Gulch. The City of Valdez is ready to negotiate a long-term lease for the total acreage or portions of Tract A and B for 99 years at $1 per year.

3) The Port of Valdez, being the northernmost ice-free, deep-water port in North America, is untroubled by excessive tides and sea-ice which results in excellent navigation and shipping safeguards. In addition, Valdez boasts one of the most complete U.S. Coast Guard operated electronic ship navigational aid systems in the world.

4) The proposed dock facilities are located within 4 to 5.5 miles from the proposed terminus site and also have direct access to Dayville Road and Richardson Highway. Deep water availability is close to shoreline.

5) The supply of groundwater is plentiful and would supply a great percentage of the site requirements, and the quality exceeds EPA's standards for drinking water.

6) No major environmental concerns exist. Of primary concern to industrial developers is the question of air quality. The present ambient air quality in Valdez is very good and well within National Ambient Air Quality Standards (NAAQS). Extensive testing for the Alpetco project indicates that a major refinery could operate in Valdez without violating air quality standards.

7) Valdez currently has all the necessary utilities, schools and other community facilities necessary to accommodate the demands of a construction boom followed by additional permanent residents without outside impact assistance for the expansion of community services and facilities.

8) The City of Valdez is completing an application for a free-trade zone in the Industrial Park. With the City's Port of Entry status, a considerable advantage can be offered to prospective industries.

9) The Port of Valdez, with the addition of the largest floating concrete dock ever constructed for general cargo use, is the fastest and most economical way for freight to move to the Interior and beyond to the North Slope. Because of our shorter distance to the Lower 48, our modern off-loading facilities, marshalling yard and storage area, considerable time and savings would be realized in pipeline and terminal construction costs.

19) Developed residential land within the City could be expanded considerably. The City presently contains undeveloped, residentially-zoned lands that could support a population in excess of 13,000.

11) Valdez is experienced in tax-exempt industrial development bond financing and stands willing to assist other industries desiring to locate in the City.

12) And finally, the topic of potential petrochemical and/or refinery development in Valdez is a popular one among the citizens of Valdez, the City Council, Chamber of Commerce and various boards and commissions, and it continues to be received with an overwhelming degree of community interest, enthusiasm and support.

More in-depth information is included in the following pages. We realize, of course, there are several hurdles the oil companies have to overcome before siting is closely examined, but by submitting this report we sincerely trust that whenever the subject arises you will remember the content of this report and give favorable consideration to the physical, environmental, and infrastructural assets Valdez has to offer.

In conclusion, the City of Valdez stands ready to assist you in developing Alaska's natural gas reserves.

Respectfully submitted,

Jim Watson

Jim Watson
City Manager

JW:LA:jd

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ORIENTATION

History of City and Site

The City of Valdez was founded near the mouth of Valdez Glacier Stream in 1897 to serve as the point of departure for an overland route to Interior Alaska, primarily supporting mining activities. At the turn of the century, Valdez was the only all-season port of entry to the Interior and was heavily promoted by steamer companies as the best all-American route to the fabulous Klondike. Thousands of gold stampeders arrived at Port Valdez, and during winter seasons horse-drawn sleds loaded with supplies and passengers would leave weekly for Fairbanks via the Valdez Trail. Thousands of others set out across Valdez Glacier; at least two-thirds of a party of 4000 perished in an attempted journey across Valdez Glacier to the Yukon in the winter of 1898-99.

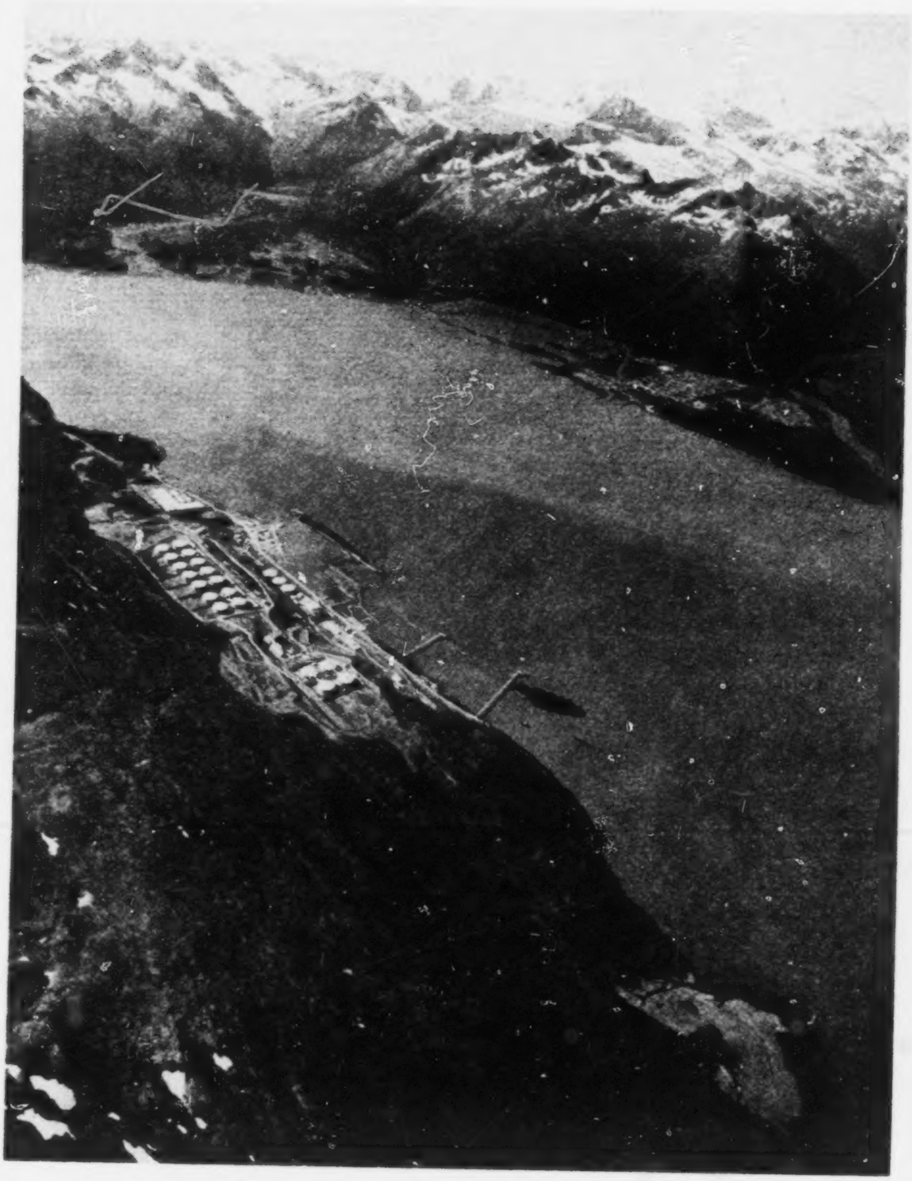
The town acquired a measure of prosperity at the turn of the century, its heyday as the transportation link to Interior mining districts. For a time it was virtually a tent city with thousands of inhabitants. However, in 1900 the U.S. Census reported the population of Valdez as 351, and in 1920 it was recorded as 466.

Completion of the Alaska Railroad from Seward to Fairbanks in 1923 ended Valdez's reign as the only all-season port of entry to the Interior. A cannery operated in Valdez during the 1930s and '40s and the city's role as a major transshipment center was revived during and shortly after World War II for military supplies to Fairbanks.

Valdez grew gradually and had about 600 residents when submarine landslides and waves following the Great Alaska Earthquake of 1964 virtually destroyed the town. After the event, townspeople rebuilt the city on approximately two square miles which comprise the current downtown area; and in 1973, the city extended its jurisdictional limits to include both sides of Port Valdez from Valdez Narrows east to Keystone Canyon.

The role of Valdez as a major transshipment center again was revived in the late 1960s and early '70s for materials and supplies for the southern portion of the Alyeska pipeline system. The Alyeska Marine Terminal was the first major industrial installation in Valdez, and during its construction the city grew from a 1970 population of 1005 to a mid-1976 peak of about 8000. Since then the city has tapered back and now has a population of about 3700.

The beginning of operation of the Alyeska Marine Terminal marked significant changes in Valdez: the primary employer traditionally had been government, employing 69 percent of the workforce prior to construction of the Alyeska terminal; but by 1979, government employed only 29 percent of the workforce and the transportation industry (which includes the Alyeska workforce) employed 22 percent. In addition, the city's tax base expanded greatly allowing for a high level of city services and capital improvements, and providing a large bonding capacity which the city is using to promote industrial growth. In addition to issuing $1.3 billion in tax-exempt bonds in support of the Alyeska terminal facility, the city has constructed over $101,390,000 in capital improvement projects over the past five years. The city remains ready to offer assistance through tax-exempt bonds to encourage further industrial development. The Valdez City Council in 1980 passed a resolution creating a municipal industrial park on a large undeveloped area of city-owned land between Valdez Glacier and the port.



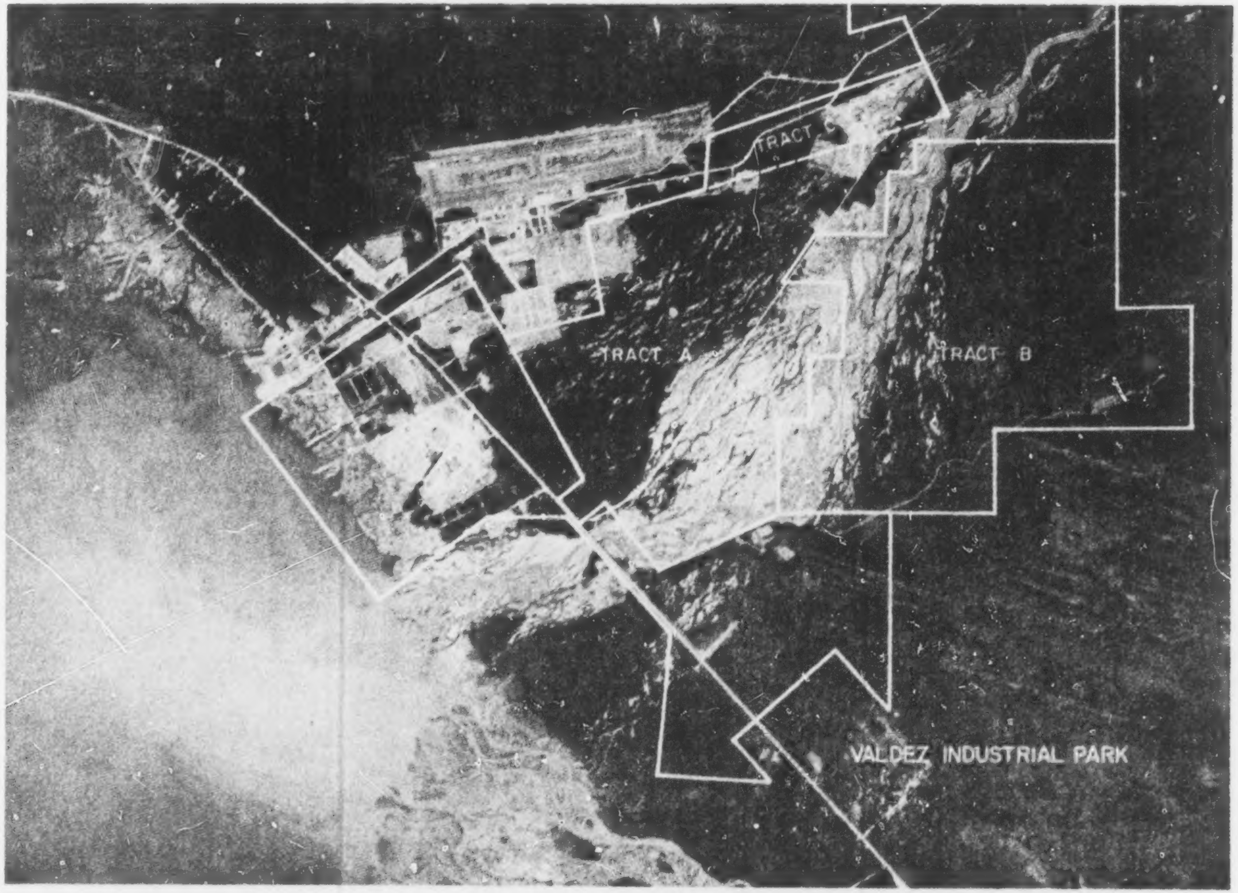
The first tract of the park to be leased was a 1425-acre parcel by Alaska Oil Company (formerly Alpetco). The firm began site preparation for a 100,000 barrel-per-day (bpd) refinery in 1980. Due to a downturn in world oil prices and the resulting lack of demand for its refined products, Alaska Oil Company was forced to discontinue its plans for the Valdez refinery project.

Size and Description of Site

The Valdez Municipal Industrial Park is comprised of some 4290 acres of land, most of which was conveyed to the City of Valdez from the State of Alaska, Department of Natural Resources, in 1979 under authority of the Municipal Entitlement Act. Upon receipt of a patent to the land, the Valdez City Council passed a resolution creating the Industrial Park, citing that its creation is in the public's best interest and that an industrial park will create additional employment opportunities for the community as well as additional economy for the state through development of its natural resources. Boundaries of the park are shown on the following illustration.

The Valdez Industrial Park is located in a glacier outwash valley at the east end of Port Valdez, about four miles east of the downtown area and immediately east of the airport. There is ready access to the Richardson Highway and the Port facilities.

The Industrial Park is intersected by Valdez Glacier Stream which forms much of the boundary between Tract A and Tract B of the land. The proposed All-Alaska Gasline terminus location, herein referred to as Tract B, is comprised of


TRACT C
TRACT A
TRACT B
VALDEZ INDUSTRIAL PARK

a parcel called Tract B on Alaska State Land Survey 79-116. The Industrial Park Tract B contains a total of about 1330 usable acres. Field investigations and studies have been conducted on Tract B during permitting and preliminary design phases for the Alpetco project. These studies provide a broad base of knowledge about Tract B.

Tract B is relatively flat and cleared with irregular boundaries roughly rectangular in shape. A gravel haul road provides limited access from the Richardson Highway. This road is currently limited because it crosses Corbin Creek which is a salmon-spawning stream. Later, the haul road is to be replaced with an access road and bridge that allow for more efficient land use.

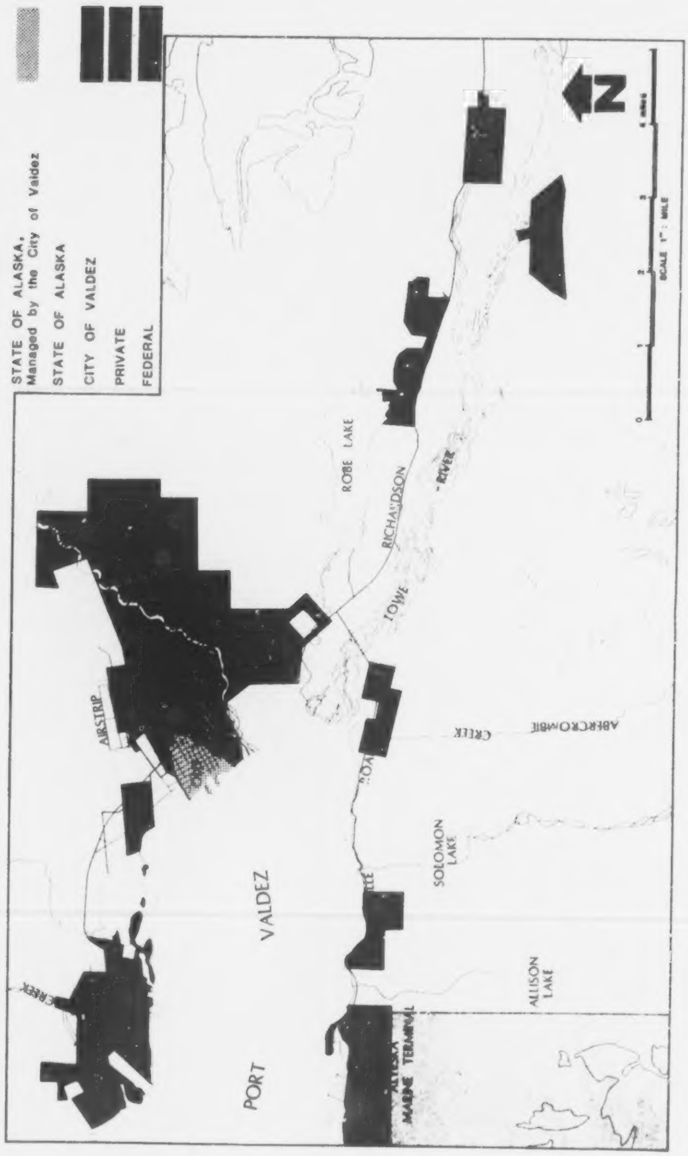
Vegetation on the site consists primarily of small clumps of young, black cottonwood, alder, and willow interspersed with large open areas covered primarily by lichens and mosses. Species diversity is low, and few hearty species are found. The site is 90 percent cleared and would require little site preparation. There are no known wetlands or other biologically sensitive areas within Tract B.

Ownership of Site and Adjacent Lands

All land bordering the Industrial Park, and Tract B specifically, is owned either by the City of Valdez or the State of Alaska. Several active gravel extraction leases exist along Valdez Glacier Stream in Tract B, but these expire by 1984.

Land Use and Planning

As a Home Rule City, Valdez exercises planning, platting


KEY
STATE OF ALASKA, Managed by the City of Valdez
STATE OF ALASKA
CITY OF VALDEZ
PRIVATE
FEDERAL
PORT
VALDEZ
CREEK
AIRSTRIP
ROBE LAKE
RICHARDSON
LOWE
RIVER
ABERCROMBIE
CREEK
SOLOMON LAKE
ALLISON LAKE
ALYESKA MARINE TERMINAL
0
1
2
3
4
SCALE 1" = 1 MILE
N

LAND OWNERSHIP

and zoning authority within its 274 square mile area. The city currently administers zoning, subdivision and trailer court ordinances. However, in recognition of new concepts in land development techniques as well as the land use demands arising from the city's growth in the past decade, these basic land use ordinances are undergoing review in conjunction with the drafting of a current Community Development Plan scheduled for completion in the fall of 1984.

Zoning

A new zoning ordinance was adopted in January, 1983. The new ordinance addresses current development techniques such as planned unit developments, townhouses, condominiums and cluster housing through an up-to-date conditional-use procedure. Another major feature of the ordinance is the designation of waterfront industrial and waterfront commercial districts designed to encourage the efficient use of currently undeveloped waterfront property. Generally, the ordinance is structured to enable more flexibility in residential land development while promoting the most functional use of the city's expansion potential.

Community Development Plan

Valdez adopted a Comprehensive Development Plan prepared in 1971 prior to Alyeska pipeline construction. While some of the Plan's recommendations were implemented, the rapid development of the community during the 1970s and economic development projections for the '80s have pointed to the need for a new comprehensive plan. A comprehensive plan will be completed in late fall of 1984, addressing the specific land-use requirements for growth in the port and related transportation industries, expansion of petroleum-related industries, fisheries and aquaculture developments, phased residential expansion, and public facility reservations. The new zoning ordinance and District Coastal Management Program will equip the city with the land-use controls to provide more effective decision making in coping with the rapid growth forecast for the '80s.

Coastal Management

Pursuant to the Alaska Coastal Management Act of 1977, Valdez will complete the Coastal Zone Management Conceptual draft in the fall of 1984. The program has been developed under the guidance of these goals:

- To enhance the economic productivity and diversification of the region;
- To sensibly open up new land for residential and industrial expansion;
- To strive for compatible multiple use of coastal lands and waters for residential, industrial, commercial, recreational and open-space activities;
- To protect and enhance coastal habitats in accordance with Alaska statutes and in concert with desired industrial expansion;
- To expedite and simplify permit procedures and project review by governmental agencies in implementing the district program.

The District Program recognizes that the City of Valdez will strive to promote economic prosperity and development while ensuring that the unfolding of economic events takes place in an orderly and sensible manner, cognizant of the environmental limitations of the District.

Floodplain Ordinance

In order to participate in the National Flood Insurance Program and to afford residents of the city the opportunity to purchase flood insurance, the City of Valdez in 1980 adopted an ordinance providing for the regulation of land use in flood hazard areas. The ordinance creates the requirement for a Development Permit to be obtained from the City of Valdez prior to construction or development in any flood hazard area identified by the Flood Insurance Administration's December 1983 Flood Insurance Study. The ordinance establishes general standards for flood protection and empowers the city building official to grant or deny the Development Permit. The Planning and Zoning Commission is responsible for hearing appeals and requests for variances from the requirements of the Floodplain Ordinance.

Harbor Description

Port Valdez is the northernmost ice-free port in Alaska. The City of Valdez, in fact, originally was founded to serve as a year-round gateway to Interior Alaska. The harbor is connected to the Gulf of Alaska and Prince William Sound by Valdez Arm and Valdez Narrows. Port Valdez itself is about 12 miles long and 3.4 miles wide with steep sides on the north and south which plunge to a depth of 787 feet over most of the length of the port. The floor of the port rises rather uniformly in the easternmost quarter to the shoreline of the former townsite.

A sill at Valdez Narrows, 850 yards wide, reaches a maximum depth of 525 feet. Tides within Port Valdez are mixed, semidiurnal with a mean height of ten feet.

Traffic in Port Valdez was light from 1964 to 1969, limited mainly to pleasure craft, commercial fishing vessels, and barges. There was no scheduled traffic until Alyeska pipeline materials began arriving in 1969. Since construction of the Alyeska Marine Terminal, traffic has increased considerably to an average of 3.4 large vessel transits per day. However, the traffic level still is well within the capability of the U.S. Coast Guard Vessel Traffic System to control. Based upon current traffic separation schemes, including one-way traffic in Valdez Narrows, 30 transits a day would be possible.

Dock facilities currently in Port Valdez include the Valdez City Dock, a pair of barge docks for barges equipped to "bottom out" at low tide; a Chevron petroleum dock; the Valdez Small Boat Harbor; the Alyeska Marine Terminal and the city's newly completed general cargo and container facility. The city's 1984 budget also includes provisions for engineering and design of a commercial boat harbor scheduled for construction in 1985. The city is currently expanding its Small Boat Harbor. These facilities are described in further detail in "Existing Marine Facilities."

Site Access

Access to Tract B is available from the Richardson Highway via the existing Glacier Stream haul road. The existing road crosses Corbin Creek which is a salmon-spawning stream.

To be used as a permanent access road, a bridge must be constructed across Corbin Creek.

Other alignments also are possible, including construction of a new access road from the Richardson Highway to the site. A right-of-way across city land would be provided for new alignments.

ENVIRONMENT

Climate and Meteorology

Weather in the Valdez area is dominated by maritime influences, and is characterized by less extreme temperature variations than other parts of the state, as well as by high humidity, high precipitation, and frequent low clouds and fog. The high mountain ridges to the north protect Valdez from extreme cold in winter, and prevent the warmer interior air from reaching Valdez in summer. The mountains to the south provide a barrier to warm, moist air off the Gulf of Alaska in winter, but cool drainage winds off the nearby glaciers during summer offset any protection the southern mountains might otherwise provide.

Temperatures average about 25°F during January (the coldest month) and 55°F during July (the warmest month). Rainfall averages about 60 inches per year with an average of nearly 8 inches in September (the wettest month) and nearly 3 inches in June (the driest month). Snowfall also is heavy, averaging about 300 inches annually and nearly 40 inches monthly from December through March. Prevailing winds are from the northeast from October through April and from the southwest from May through September. During winter months, occassional strong northeasterly winds occur.

Air Quality

The entire Valdez Basin is designated as an attainment area for all pollutants. The pollutant concentration levels have been monitored continuously for several years and pollutant concentration levels except ozone have been consistently less than 20 percent of National Ambient Air

Quality Standards (NAAQS), and maximum ozone concentration was 50 percent of allowable levels.

Topography

The southern boundary of the Industrial Park Tract B is at an elevation of approximately 45 feet above mean sea level and begins approximately one mile inland from the shore of Port Valdez. The valley floor rises in a very gradual slope from this point in a northeasterly direction to the base of the Valdez Glacier, approximately five miles inland. The prime central portion of the Industrial Park site is at an elevation of approximately 100 feet. The slope is a very uniform gradient of about .08 percent. Spot elevations are noted on an illustration following.

Drainage

Valdez Glacier Stream, draining an area of approximately 157 square miles, is the principal drainage system near the Industrial Park site. All drainage in this area either permeates directly into the coarse glacial outwash soils or drains into Valdez Glacier Stream. The transverse grades on the site are very flat, and most runoff on Tract B probably permeates the soil before reaching Valdez Glacier Stream.

Severe channel erosion and lateral migration historically have occured on Valdez Glacier Stream. Today, however, the stream has deeply cut banks near its headwaters, indicating that scouring of the bed material is the general trend there. Terraces at various levels along the stream show the recent history of the river has been one of degradation rather than aggradation, and the stream, characterized by braiding in the early 1900s, appears to be channelizing in a meandering pattern at present.

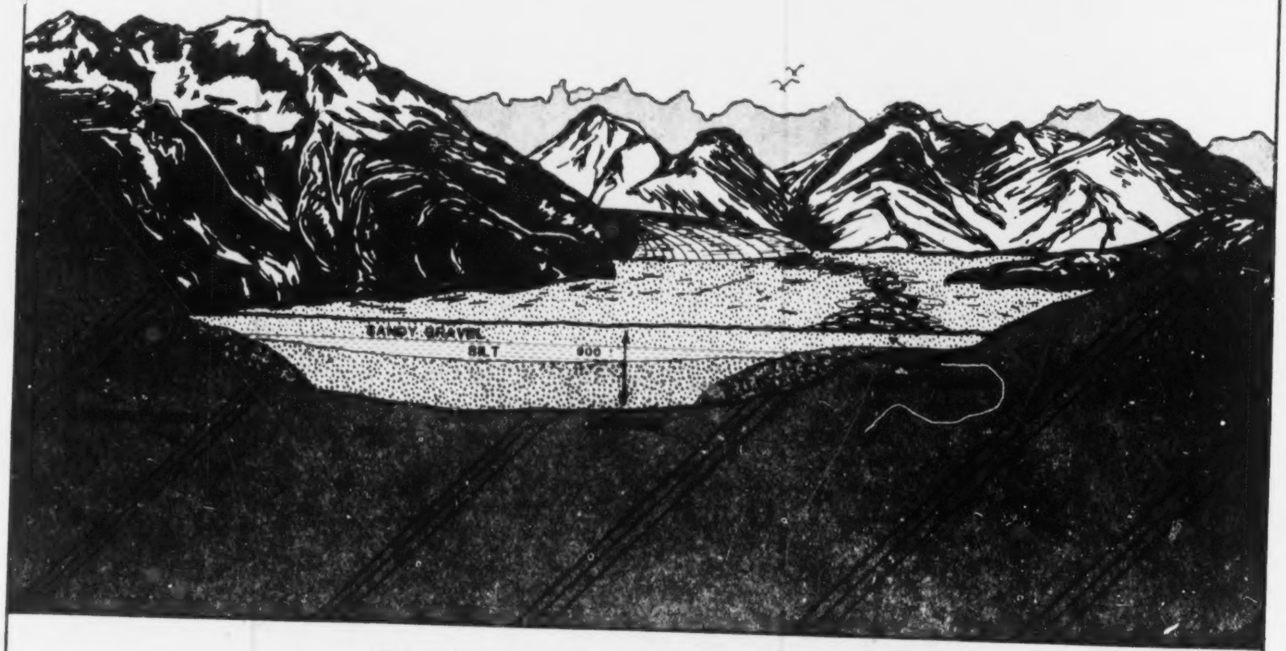
Geology

Port Valdez is located in Prince William Sound, an extensive embayment near the center of the Gulf of Alaska. Prince William Sound is separated from Interior Alaska by the steep slopes of the Chugach, Kenai, and St. Elias Mountains. The mountains around the sound are rugged and contain the most extensive system of valley glaciers in North America. Lower elevations are characterized by rounded glacial carved valleys.

Prince William Sound is dotted by nearly 200 islands. Numerous long, narrow fjords as well as lesser bays and coves cut into its shoreline. Port Valdez is the northeastern-most extension of the sound.

The port is surrounded by steep mountain walls which rise to 5000 feet. The steep valley walls continue into the port forming a steep-sided, flat-bottom trough about 787 feet deep for most of its length. A narrow, shallow entrance called Valdez Narrows links it to Valdez Arm and Prince William Sound.

Sediment deposition is extensive at the mouths of various streams which flow into Port Valdez. A large, broad delta of unconsolidated sediments in excess of 600 feet thick is formed at the eastern end of the fjord by Valdez Glacier Stream and the Robe and Lowe Rivers.


SANDY GRAVEL
SILT
900

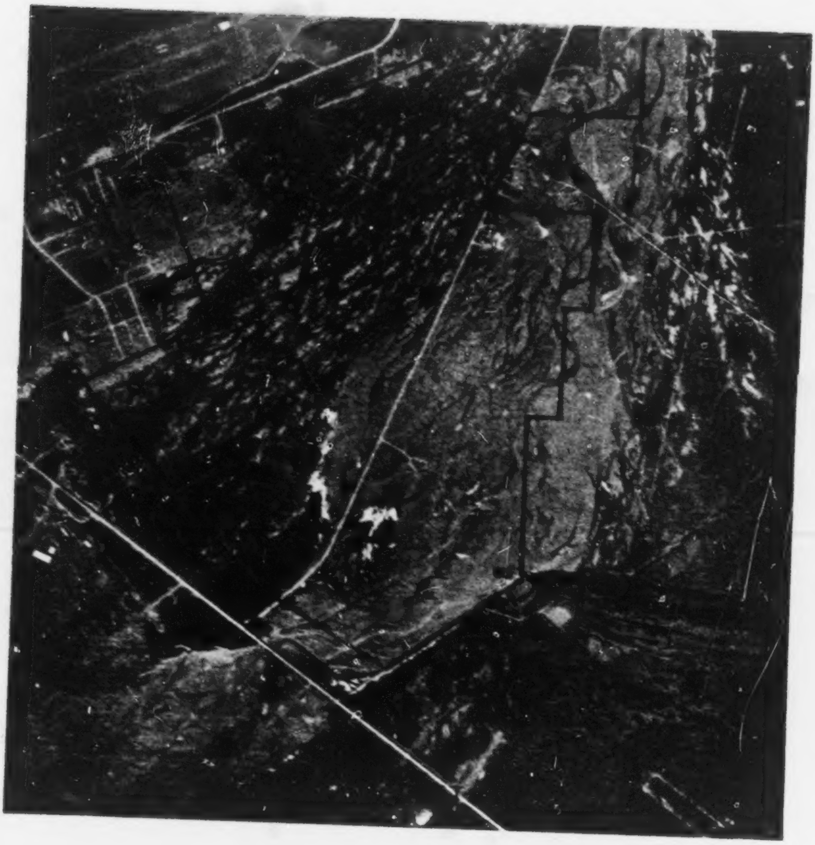
TYPICAL GEOLOGIC PROFILE

The Valdez Industrial Park is located about one mile south of Valdez Glacier and is intersected by Valdez Glacier Stream. Valdez Glacier Stream forms most of the western boundary of Tract B of the Industrial Park.

Data derived from previous drilling and seismic refraction studies indicate that the Industrial Park area is the result of glacial scouring of bedrock by Corbin and Valdez Glaciers. Depth to bedrock on Tract B is estimated at 700 to 900 or more feet.

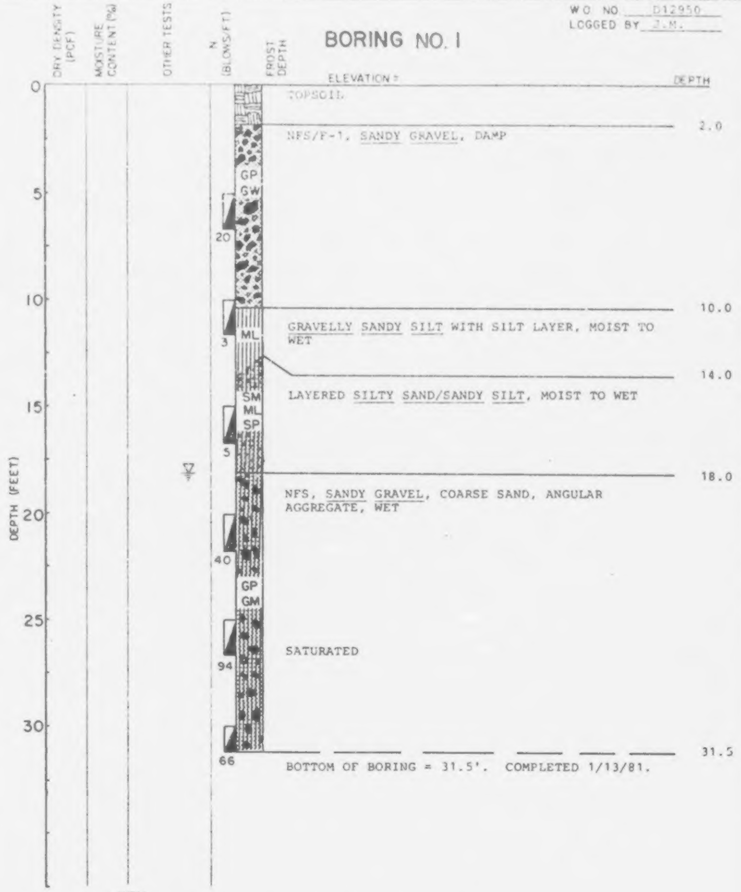
Soils

The Industrial Park proposed gasline terminus site is located in a broad and deep glaciated valley which has been filled with recent glaciofluvial (glacial outwash) deposits to depths of 700 to 900+ feet. The Tract B soil profile and the pre-1964 Valdez townsite soil profiles to the southwest are quite similar. Shallow test holes on Tract B revealed soils typical to the soils found on adjacent tracts, and it is assumed that the similarity continues with depth. Test hole locations and logs are shown on the following pages. The soil stratigraphy of the outwash deposit can be described generally as a three-layer system--an upper mantle of coarse grain, slightly silty sandy gravel with many cobbles and boulders within the gravel matrix; an intermediate layer of slightly plastic silt which is slightly to moderately compressible; followed by a layer of dense to very dense silty sandy gravel which is probably over-consolidated till. The upper outwash deposits should perform well as a foundation-bearing material, and soil bearing pressures of up to 5000 psf should be readily attained. If the upper surface of the intermediate layer silt remains fairly uniform across the valley (approximately



W O NO D12950
LOGGED BY J.M.

BORING NO. 1


DRY DENSITY (PCF)
MOISTURE CONTENT (%)
OTHER TESTS
N (BLOWS/FT)
FROST DEPTH
ELEVATION =
DEPTH
DEPTH (FEET)
0
5
10
15
20
25
30
GP GW
ML
SM ML SP
GP GM
20
3
5
40
94
66
2.0
10.0
14.0
18.0
31.5

TOPSOIL

NFS/F-1, SANDY GRAVEL, DAMP

GRAVELLY SANDY SILT WITH SILT LAYER, MOIST TO WET

LAYERED SILTY SAND/SANDY SILT, MOIST TO WET

NFS, SANDY GRAVEL, COARSE SAND, ANGULAR AGGREGATE, WET

SATURATED

BOTTOM OF BORING = 31.5'. COMPLETED 1/13/81.

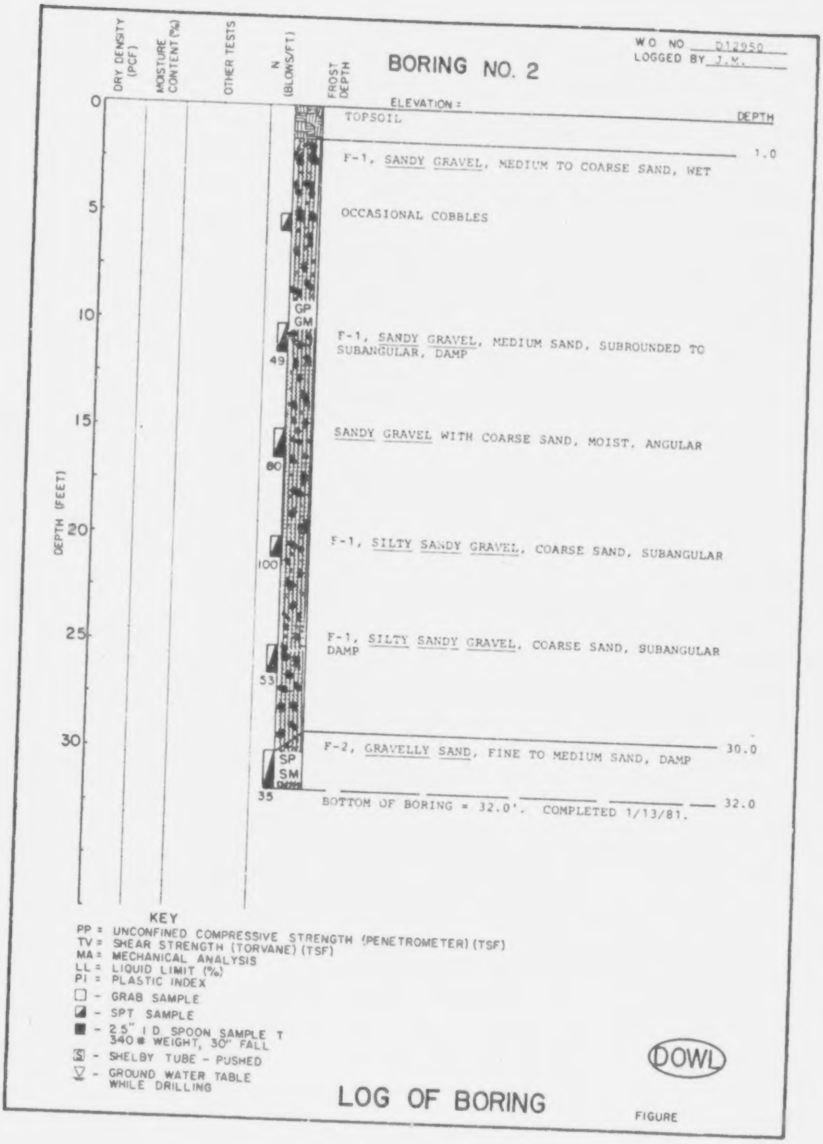
KEY

PP = UNCONFINED COMPRESSIVE STRENGTH (PENETROMETER) (TSF)
TV = SHEAR STRENGTH (TORVANE) (TSF)
MA = MECHANICAL ANALYSIS
LL = LIQUID LIMIT (%)
PI = PLASTIC INDEX
☐ - GRAB SAMPLE
◪ - SPT SAMPLE
■ - 2.5" I.D. SPOON SAMPLE T 340 # WEIGHT, 30" FALL
🅂 - SHELBY TUBE - PUSHED
▽ - GROUND WATER TABLE WHILE DRILLING

DOWL

LOG OF BORING

FIGURE


DRY DENSITY (PCF)
MOISTURE CONTENT (%)
OTHER TESTS
N (BLOWS/FT)
FROST DEPTH
DEPTH (FEET)
0
5
10
15
20
25
30
GP GM
49
80
100
53
SP SM
35

W O NO. D12950
LOGGED BY J.M.

BORING NO. 2

ELEVATION =

	DEPTH
TOPSOIL	
F-1, SANDY GRAVEL, MEDIUM TO COARSE SAND, WET	1.0
OCCASIONAL COBBLES	
F-1, SANDY GRAVEL, MEDIUM SAND, SUBROUNDED TO SUBANGULAR, DAMP	
SANDY GRAVEL WITH COARSE SAND, MOIST, ANGULAR	
F-1, SILTY SANDY GRAVEL, COARSE SAND, SUBANGULAR	
F-1, SILTY SANDY GRAVEL, COARSE SAND, SUBANGULAR DAMP	
F-2, GRAVELLY SAND, FINE TO MEDIUM SAND, DAMP	30.0
BOTTOM OF BORING = 32.0'. COMPLETED 1/13/81.	32.0

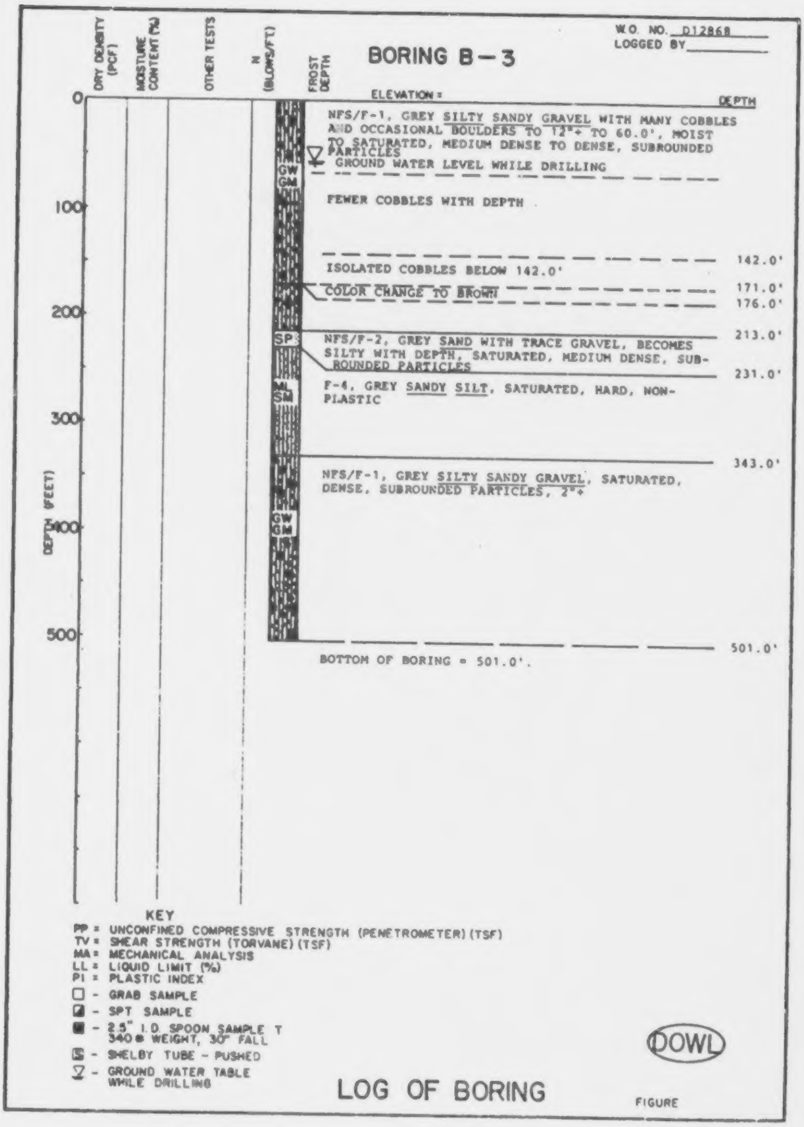
KEY

PP = UNCONFINED COMPRESSIVE STRENGTH (PENETROMETER) (TSF)
TV = SHEAR STRENGTH (TORVANE) (TSF)
MA = MECHANICAL ANALYSIS
LL = LIQUID LIMIT (%)
PI = PLASTIC INDEX
☐ - GRAB SAMPLE
◩ - SPT SAMPLE
■ - 2.5" I D SPOON SAMPLE T 340 # WEIGHT, 30" FALL
S - SHELBY TUBE - PUSHED
▽ - GROUND WATER TABLE WHILE DRILLING

DOWL

LOG OF BORING

FIGURE


DRY DENSITY (PCF)
MOISTURE CONTENT (%)
OTHER TESTS
N (BLOWS/FT)
FROST DEPTH
DEPTH (FEET)
0
100
200
300
400
500
GW GM
SP
ML SM
GW GM

W.O. NO. D12868
LOGGED BY________

BORING B-3

ELEVATION =

DEPTH

NFS/F-1, GREY SILTY SANDY GRAVEL WITH MANY COBBLES AND OCCASIONAL BOULDERS TO 12"+ TO 60.0', MOIST TO SATURATED, MEDIUM DENSE TO DENSE, SUBROUNDED PARTICLES

GROUND WATER LEVEL WHILE DRILLING

FEWER COBBLES WITH DEPTH

142.0'

ISOLATED COBBLES BELOW 142.0'

171.0'

COLOR CHANGE TO BROWN

176.0'

213.0'

NFS/F-2, GREY SAND WITH TRACE GRAVEL, BECOMES SILTY WITH DEPTH, SATURATED, MEDIUM DENSE, SUBROUNDED PARTICLES

231.0'

F-4, GREY SANDY SILT, SATURATED, HARD, NON-PLASTIC

343.0'

NFS/F-1, GREY SILTY SANDY GRAVEL, SATURATED, DENSE, SUBROUNDED PARTICLES, 2"+

501.0'

BOTTOM OF BORING = 501.0'.

KEY

PP = UNCONFINED COMPRESSIVE STRENGTH (PENETROMETER) (TSF)
TV = SHEAR STRENGTH (TORVANE) (TSF)
MA = MECHANICAL ANALYSIS
LL = LIQUID LIMIT (%)
PI = PLASTIC INDEX
☐ - GRAB SAMPLE
◪ - SPT SAMPLE
■ - 2.5" I.D. SPOON SAMPLE T 340 # WEIGHT, 30" FALL
🅂 - SHELBY TUBE - PUSHED
∇ - GROUND WATER TABLE WHILE DRILLING

DOWL

LOG OF BORING

FIGURE

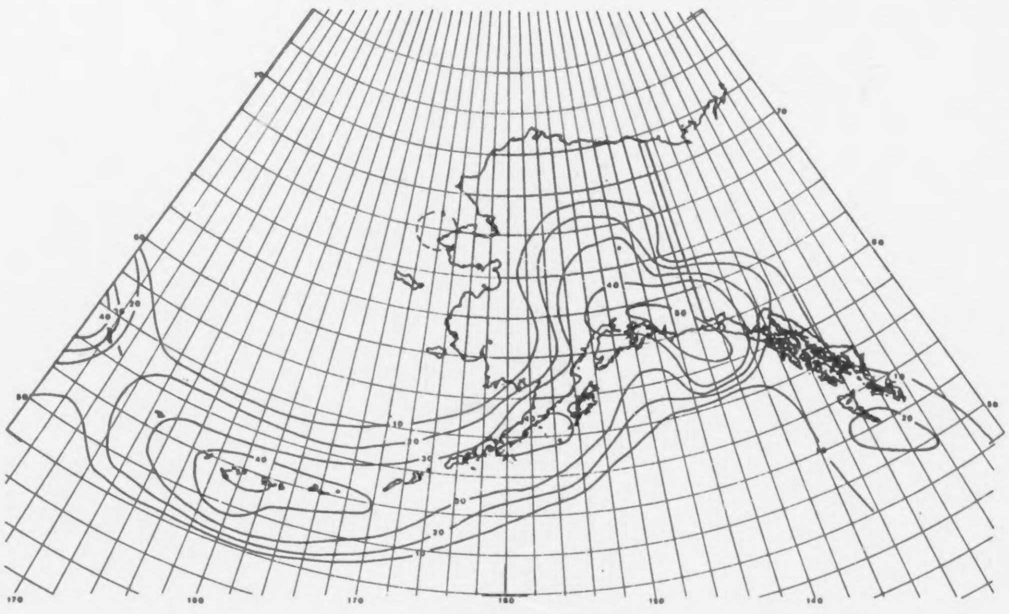
200 feet below the present ground surface), long-term settlement of structures founded on shallow spread footings or mats should be insignificant.

If the groundwater table is intercepted during construction of footings or buried pipelines, dewatering of the excavations would be required for stability of the sides of the excavation. However, the probable permeability of the soil is such that standard dewatering techniques could be readily employed.

Seismology

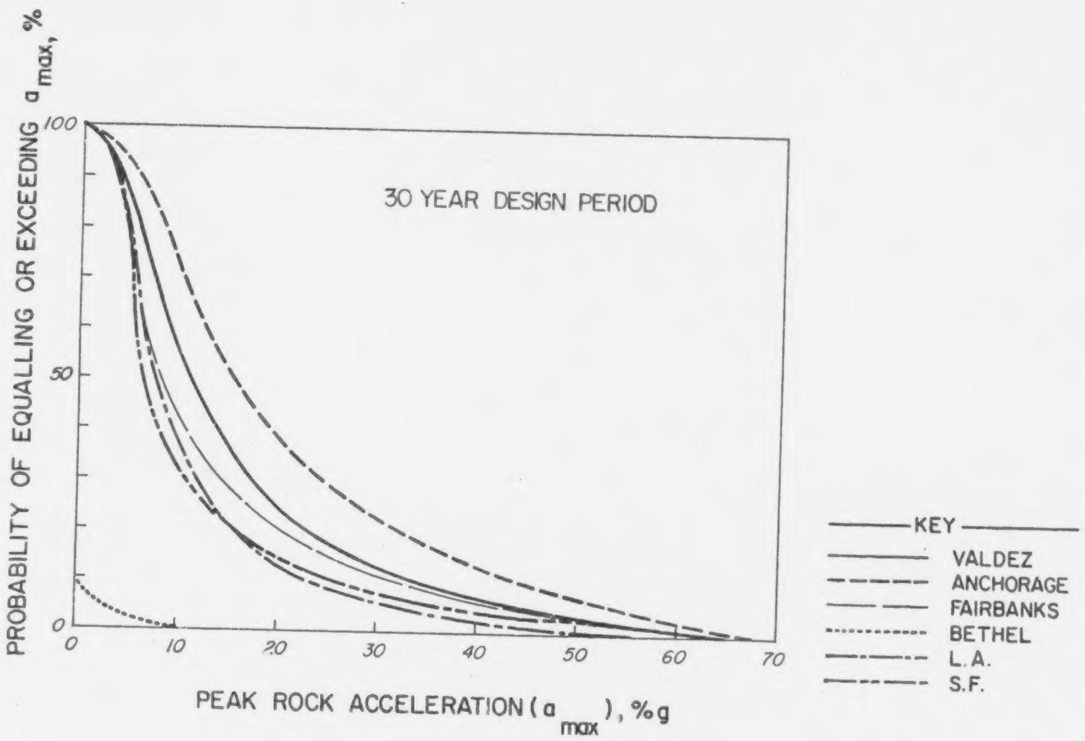
The seismic exposure at this site is similar to that of most tidewater locations in southern Alaska, and can be compared in a general sense to that of southern California, as shown on the following figures. Southern Alaska is seismically active since it lies along the northern margin of the zone of impingement between the Pacific and North American tectonic plates. The site under consideration can be expected to be affected by strong ground shaking during the design life of an industrial facility (assumed to be at least 30 years). Depending on the nature of the earthquake (size, location, etc.) the soil deposit at the site may or may not appreciably amplify the shaking produced in the bedrock below. The degree of amplification and the range of frequency of shaking for which amplification might take place can only be assessed with a detailed ground response analysis. However, the components of the proposed facility can be designed and constructed to perform satisfactorily during probable seismic events, which may affect the site.

There is historic evidence which implies liquefaction has not occurred within Tract B during past major


70
60
50
170
180
140
10
20
30
40

Seismic Risk
(Maximum Rock Acceleration)

t = 30 Years
P = 10 %
Contours in % g


30 YEAR DESIGN PERIOD
PROBABILITY OF EQUALLING OR EXCEEDING a_{max}, %
100
50
0
0
10
20
30
40
50
60
70
PEAK ROCK ACCELERATION (a_{max}), %g
KEY
VALDEZ
ANCHORAGE
FAIRBANKS
BETHEL
L. A.
S.F.

earthquakes--the most recent and notable being the 1964 Great Alaska Earthquake. There is a history of strong ground shaking and there are isolated layers of saturated uniform fine sand which indicate a potential for liquefaction exists in the general area; but whether these controlling factors exist in the requisite critical combination at the site is not currently known. However, ground cracking and stretching occurred during the 1964 event within an area up to 5000 feet wide along the seaward face of the outwash deposits of the Valdez Glacier, and none of these phenomena was observed within Tract B proposed for the gasline terminus site. The apparent "stability" of the site may be accounted for in the coarseness of the soil fabric at the site, the density of deposit, or the absence of a high groundwater table. Any or all of these factors could inhibit the potential for liquefaction in the area proposed for the facility.

Permafrost and Residual Glacier Ice

Several factors indicate that the Industrial Park area is free of frozen materials except on a seasonal basis. The permeability of the soils in the area, and the movement of groundwater would have a tendency to melt buried ice rapidly (in a geologic time frame). Also, velocity anomolies were noticeably absent in a previous seismic study performed on Tract B of the Industrial Park, and no indication of frozen ground was discovered while drilling 16 test holes and water wells. During test pumping of a well on Tract B, the temperature of deep groundwater was found to be 41.5 degrees Fahrenheit. These factors support the likelihood that the Industrial Park area is free of permafrost and residual glacier ice.

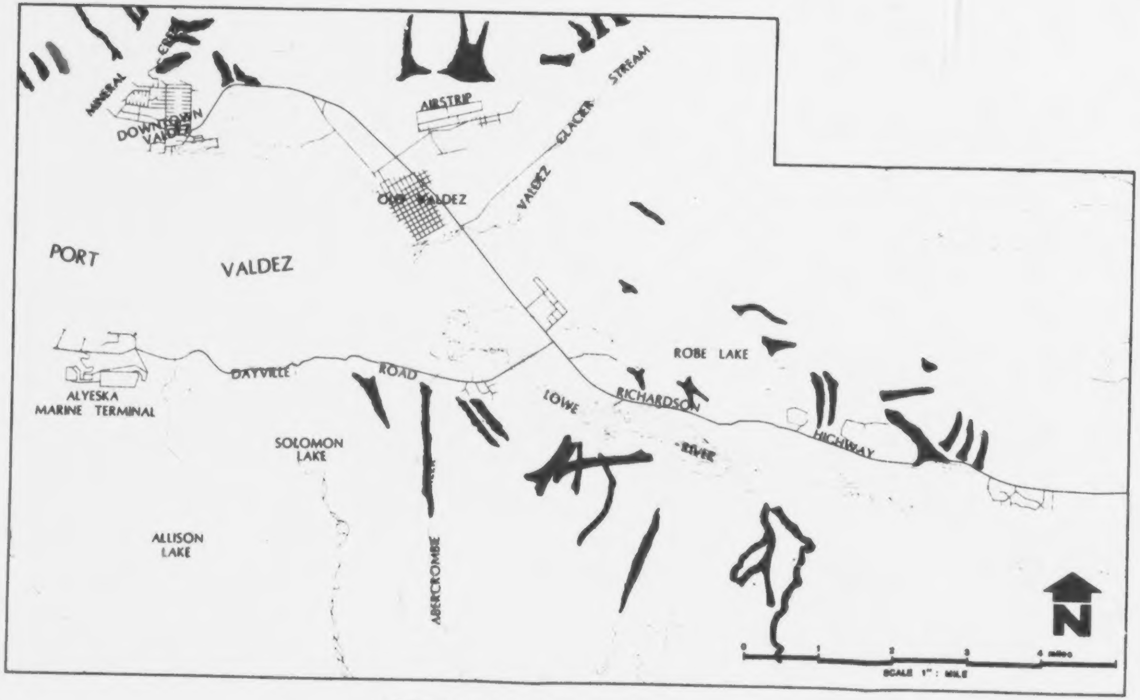
Avalanche and Mass Wasting Potential

A study performed for the City of Valdez in 1980 identifies areas of potential mass wasting, and identifies avalanche starting zones, shutes, and runout zones. No such areas affect the subject site of possible right-of-way alignments to a potential dock site. Zones identified as having some potential for these hazards to occur are identified on the following maps.

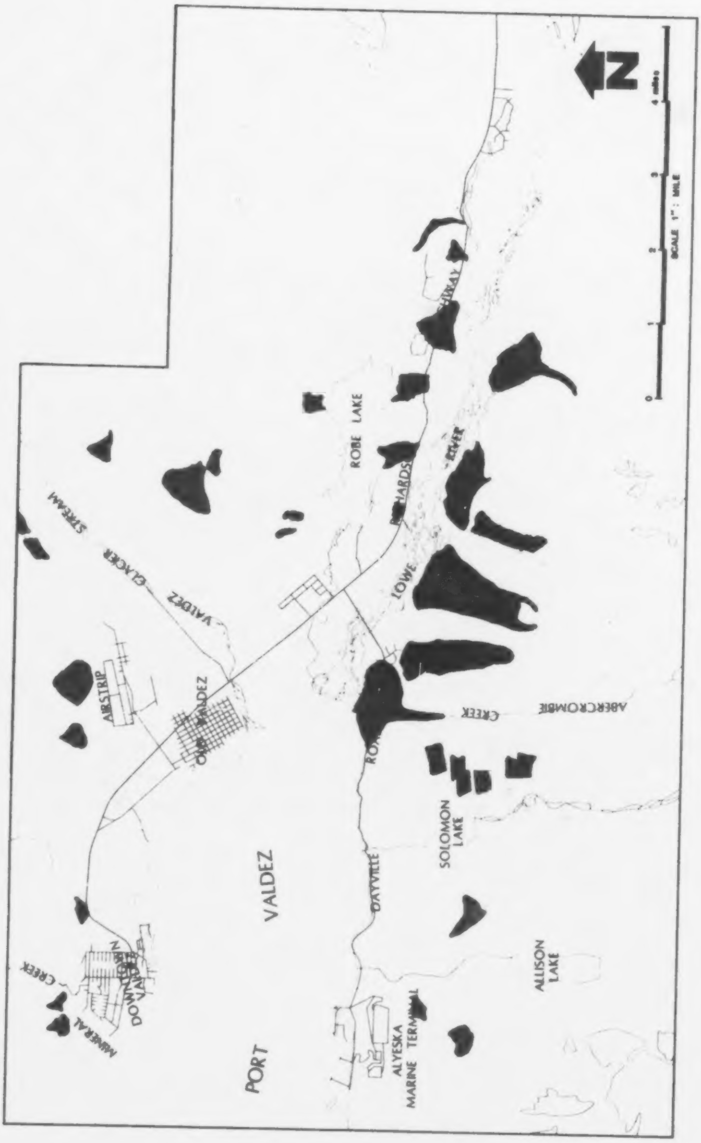
Flood Potential

There is little potential for flooding on Tract B of the Industrial Park. Minor portions of the tract east of the haul road fall within the one percent or 100-year floodplain for Valdez Glacier Stream. Delineation of the 100-year floodplain considers the potential sudden release of water stored in or dammed by nearby glaciers. The history of glacial lake outbursts in the area is not recorded.

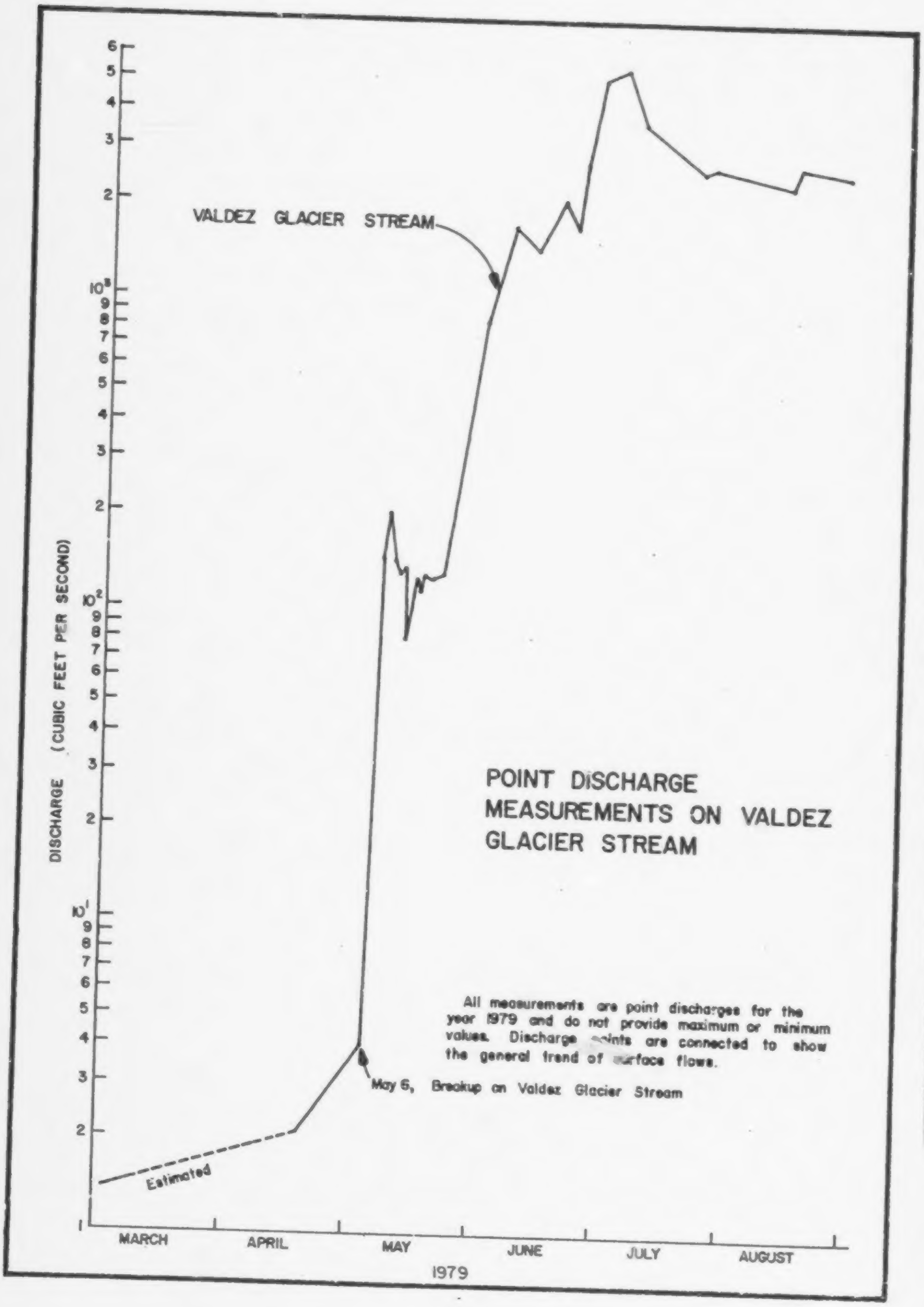
As a part of an ongoing flood risk study for the City of Valdez, consultants made field reconnaissance trips in the area in the summers of 1979 and 1980 and identified five glacial lakes within the drainage basin of Valdez Glacier Stream. One of the lakes was observed to be blocked off by a lateral moraine rather than an ice dam and hence is not considered a potential threat. Visual observations and relatively high discharge values measured on Valdez Glacier Stream have shown that two of these lakes drained sub-glacially during the summer of 1979, releasing an estimated 1.0 billion cubic feet of water into Valdez Glacier Stream. The total flow rate in Valdez Glacier Stream during the period of this discharge was 5000 to 6000 cubic feet per second (cfs). One of the lakes that released potentially


MINERAL
CREEK
DOWNTOWN VALDEZ
AIRSTRIP
VALDEZ GLACIER STREAM
OLD VALDEZ
PORT
VALDEZ
ALYESKA MARINE TERMINAL
DAYVILLE ROAD
ROBE LAKE
LOWE RIVER
RICHARDSON HIGHWAY
SOLOMON LAKE
ALLISON LAKE
ABERCROMBIE
N
0
1
2
3
4 miles
SCALE 1" : MILE

POTENTIAL AVALANCHE ZONES


PORT VALDEZ
DOWNTOWN VALDEZ
MINERAL CREEK
OLD VALDEZ
AIRSTRIP
VALDEZ GLACIER STREAM
ROBE LAKE
RICHARDS
HWAY
LOWE RIVER
ABERCROMBIE CREEK
RO
DAYVILLE
SOLOMON LAKE
ALLISON LAKE
ALYESKA MARINE TERMINAL
N
0
1
2
3
4 miles
SCALE 1" : MILE

POTENTIAL MASS WASTING ZONES



POINT DISCHARGE MEASUREMENTS ON VALDEZ GLACIER STREAM

All measurements are point discharges for the year 1979 and do not provide maximum or minimum values. Discharge points are connected to show the general trend of surface flows.

May 6, Breakup on Valdez Glacier Stream

could drain into either Valdez Glacier Stream or the Lowe River drainage basin. The fourth lake is a small lake on the west side of Valdez Glacier that would have a relatively low release discharge. The fifth lake lies near the terminus of the Valdez Glacier and is fed by meltwaters from Camicia Glacier. It currently is not being dammed by the glacier. The discharge of the glacial lakes in 1979 posed no flood threat to Valdez Glacier Stream, and in fact was virtually unnoticed by the casual observer. The approximate boundary of the one percent or 100-year floodplain for Valdez Glacier Stream, which does consider release of these lakes, is shown on the following illustration.

A majority of the drainage in Valdez Glacier Stream is produced by glacier melt, snowmelt and rainfall. The following plot of discharge measurements on Valdez Glacier Stream during the peak flow period of 1979 shows flow levels during what could be considered a fairly typical year. The peak flows of nearly 6000 cfs produced during July 1979 indicate the effect of the glacial lake discharge.

No other potential flood hazards are known that could affect the Industrial Park. To fully assess the potential of cumulative worst case discharges in Valdez Glacier Stream, the City of Valdez retained consultants in 1981 to make a comprehensive assessment of the flood potential throughout this area. Final results of this investigation conclude that no potential flood hazards are known that could affect the Industrial Park. However, because of erosion potential levy or diking efforts will probably be required.

Groundwater

Environmental studies performed throughout Tract B of the

Industrial Park for Alaska Oil Company in 1979 provide information about the local groundwater system. Studies included drilling 16 soil test holes and test water wells. There is sufficient reason to believe that the groundwater conditions on Tract A west of Glacier Stream are similar to those verified on Tract B. The quality of groundwater tested from Tract B meets or exceeds State of Alaska and Environmental Protection Agency standards for drinking water, and the available supply is plentiful. An analysis of a groundwater sample from Tract B follows.

Two major aquifer systems were found during studies for Alaska Oil Company, an upper, unconfined aquifer and a lower, confined (or artesian) aquifer. Wells in the region probably tap only the upper formation. The upper aquifer is highly permeable. The aquifers appear to be separated by a layer of silty sand/sandy silt which is quite firm and highly impermeable. The thickness of the impermeable formation varied from about 10 feet near the eastern edge of Tract B to more than 112 feet near the northern edge.

The static water level of the upper aquifer was found at a depth of approximately 50 feet on the northern portion of Tract B, and was within 10 feet or less at the southern edge of that site. Two test holes on Tract A showed findings consistent with these measurements. The water table was not encountered in the 30-foot depth of the northernmost test hole, and the water table was encountered at about 18 feet in the southernmost test hole, located about 1/2 mile north of the Richardson Highway. Logs of those holes are included in the "Soils" discussion.

The floors of the glacial-carved valleys of the Valdez region are formed predominantly of very permeable sands and gravels, deposited by the glacial outwash streams.

Recharge to the aquifers comes from the streams which flow through the valleys, as well as from the high amount of direct rainfall occurring during the summer months. During winter, many of the streams dry up as glacial melt and rainfall cease. Thus, recharge to the aquifers occurs primarily during summer months. The water table elevation declines during winter months due to this reduction of recharge, even where no man-made withdrawals are made. The following figures concerning test wells east of Glacier Stream illustrate this fluctuation.

Due to the low density of the Valdez population and the absence of significant water-using industry in the region, very little use is being made of the existing groundwater resource.

Surface Water

The only body of water which crosses Tract B of the Industrial Park is Valdez Glacier Stream, described in the "Drainage" discussion. The stream is fed primarily by meltwater from the glacier and snowfields, and by rainfall. During winter months, the stream is dry at its upper reaches, and the flow is about 0.4 to 2 cubic feet per second (cfs) at the Richardson Highway bridge. Ice thickness varies from one to two feet. In the summer, normal flows are in the range of 1600 to 2000 cfs with large diurnal fluctuations.

In summer, suspended sediments, primarily glacial flour, clays and silts, impart high turbidity, beyond drinking water standards, to the water of Valdez Glacier Stream. The stream is not a fish habitat, nor does Tract B contain any anadromous fish stream or other know biologically sensitive habitat.

Surface waters of the Valdez area in general are not year-round sources of water. Those streams or bodies of water which are not silt-laden are productive salmon spawning or rearing areas. Because of the ample supply of groundwater, use of surface waters as sources of supply for drinking or industrial purposes is not considered.

Wetlands

Tract B contains no known wetland area and only minor areas of the one percent of 100-year floodplain for Valdez Glacier Stream (which was delineated in "Flood Potential").

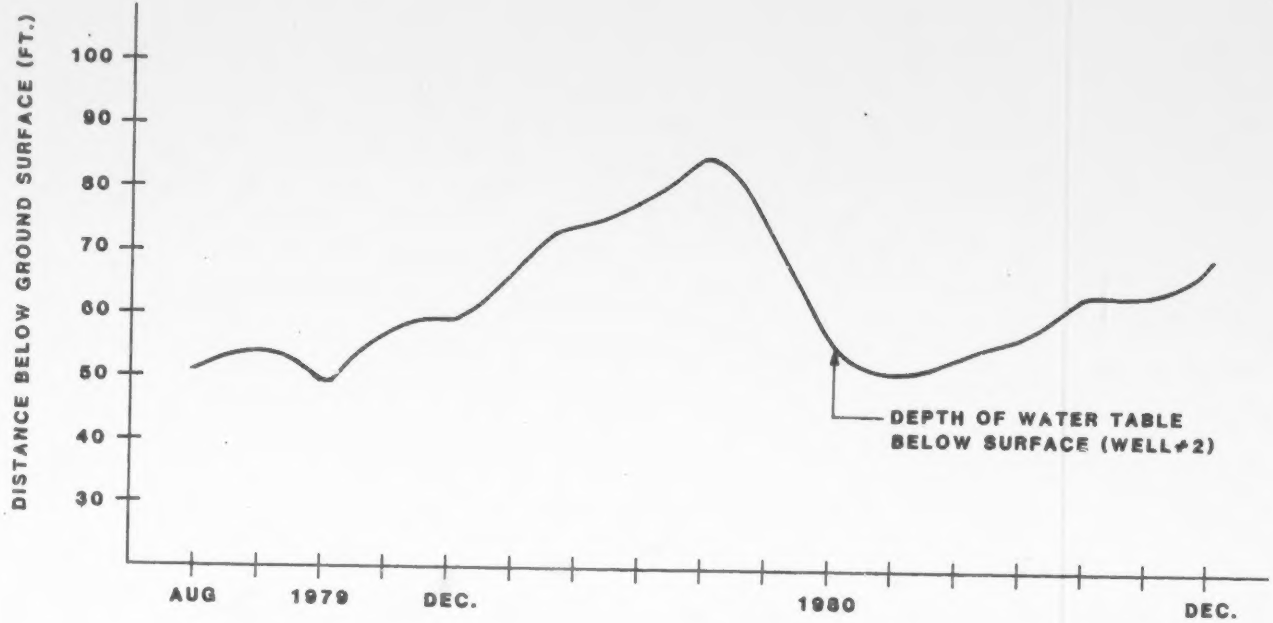
GROUNDWATER QUALITY

Following are results of a groundwater quality analysis conducted by Chemical and Geological Laboratories of Alaska, Inc., for Test Well B-2 (Upper Aquifer), Valdez Industrial Park Tract B.

	mg/ℓ		mg/ℓ
Ag, Silver	<0.003	Ti, Titanium	<0.01
Al, Aluminum	0.01	W, Tungsten	<0.01
As, Arsenic	<0.05	V, Vanadium	<0.01
Au, Gold	<0.01	Zn, Zinc	0.006
B, Boron	0.01	Zr, Zirconium	<0.01
Ba, Barium	<0.01	Ammonia-N	<0.02
Bi, Bismuth	<0.05	Nitrate-N	0.9
Ca, Calcium	24	Nitrite-N	<0.01
Cd, Cadmium	<0.0005	Phosphorus-P	0.01
Co, Cobalt	<0.01	Chloride	<2
Cr, Chromium	<0.01	Fluoride	0.6
Cu, Copper	0.003	Cyanide	<0.002
Fe, Iron	0.02	Sulfate	1
Hg, Mercury	0.0003	Total Dissolved Solids	71
K, Potassium	1.4	Hardness as $CaCO_3$	67
Mg, Magnesium	1.6	Alkalinity As $CaCO_3$	62
Mn, Manganese	<0.01	Oil & Grease	<0.1(*)
Mo, Molybdenum	<0.01	Hydrogen Sulfide	<0.003
Na, Sodium	2.2	Iron Bacteria	0
Ni, Nickel	<0.01	mmhos Conductivity	190
P, Phosphorous	0.01	pH Units	6.8
Pb, Lead	<0.02	Turbidity NTU	<1
Pt, Platinum	<0.01	Color Units	<5
Sb, Antimony	<0.01	Drinking Water Analysis for Total Coliform Bacteria	Satisfactory
Se, Selenium	<0.01		
Si, Silicon	3.6	Cation-Anion Balance	+0.08
Sn, Tin	<0.01		
Sr, Strontium	0.16		

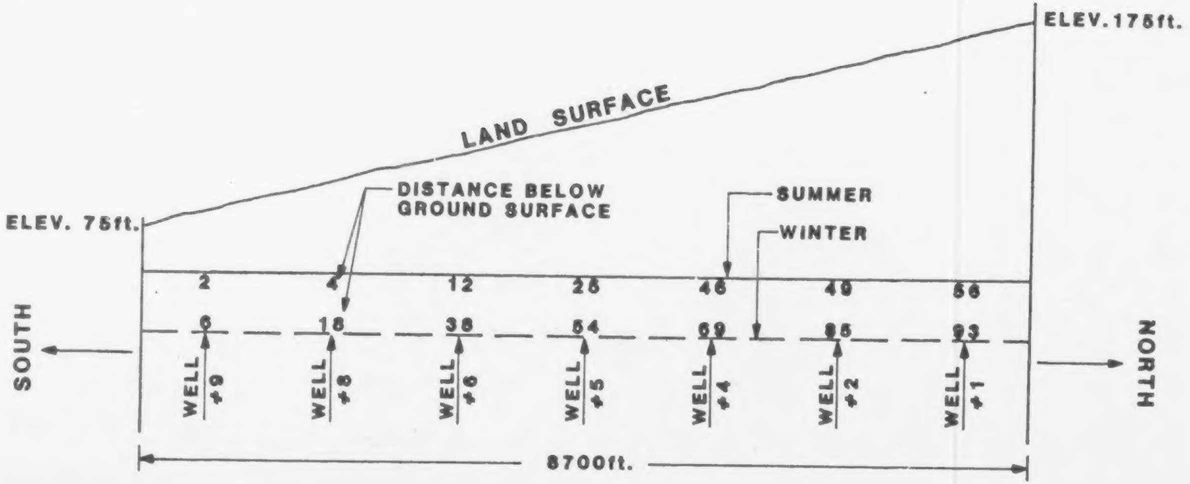
* Lowest detection limit obtainable with amount of sample submitted.

SEASONAL WATER TABLE FLUCTUATION IN A REPRESENTATIVE TEST WELL EAST OF VALDEZ GLACIER STREAM 1979/80 RECORDS



REPRESENTATIVE SUMMER & WINTER STATIC GROUNDWATER LEVELS EAST OF VALDEZ GLACIER STREAM

1979/80 RECORDS


ELEV. 75ft.
ELEV. 175ft.
LAND SURFACE
DISTANCE BELOW GROUND SURFACE
SUMMER
WINTER
2
4
12
25
46
49
56
6
18
38
54
69
85
93
WELL #9
WELL #8
WELL #6
WELL #5
WELL #4
WELL #2
WELL #1
SOUTH
NORTH
8700ft.

MARINE AND HARBOR CHARACTERISTICS

Marine Transportation

Throughout its history, Valdez experienced surges in economic growth when it served as a transportation link to the Interior. The oil pipeline and marine terminal ended that dependence and stabilized the city's economy. Valdez ranks as a major West Coast port because of the high volume of crude oil exported through the marine terminal.

Port of Valdez Shipping in Tons

Year	Fish	Dry Cargo	Crude Oil	Total
1981	1,750	2,250	85,973,086	85,977,086
1982	5,875	3,500	85,643,050	85,652,425
1983	10,000	4,750	86,163,943	86,178,693
Total Increase	570%	210%	1%	>1%
		Projected Growth		
1984	15,950	64,750	86,251,219	86,331,919
1985	19,400	72,000	86,243,195	86,334,595

Marine Highway System

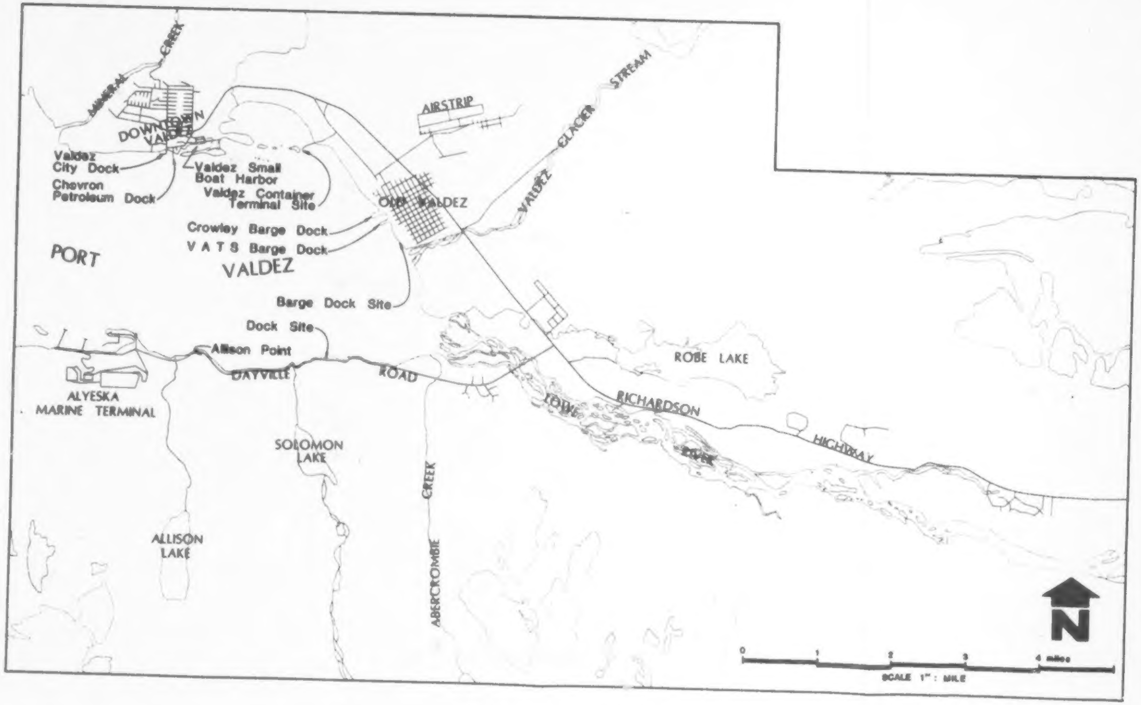
The Alaska Marine Highway System provides ferry service to Valdez and other cities in Prince William Sound. The M/V Bartlett operates between Valdez and Whittier from mid-May to late September (170 passengers/38 standard vehicles). The Bartlett carries most of its traffic in June, July and August, and it is frequently full. The M/V Tustumena (200 passengers/54 standard vehicles) calls at Port Valdez weekly, year-round on its Cordova to Seward route.

Existing Marine Facilities

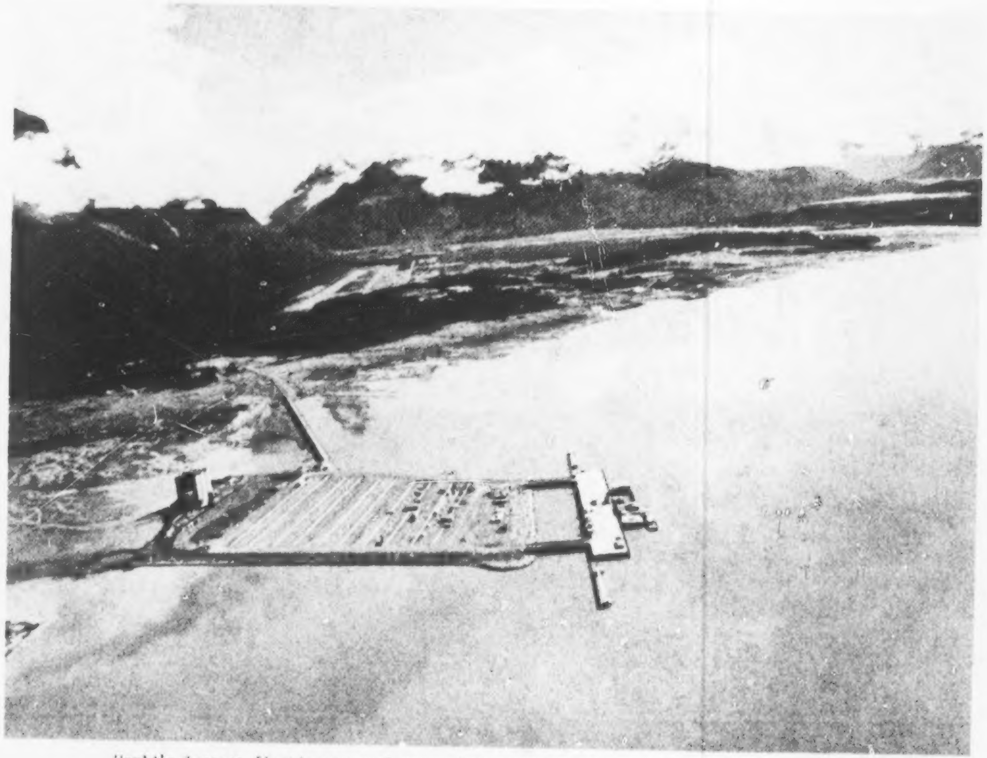
Valdez City Dock: Located near the downtown area on the north slope of the port, the wooden city dock on wood piles is 600 feet long and 60 feet wide with a depth of -33 feet MLLW at its face. Built in 1967, the city dock got a major facelift in 1980 with new firelines, two sewer dump stations and freshwater capabilities. The dock area also includes a storage warehouse and fish processing plant. Most of the city dock traffic is State Marine Highway System ferries and general cargo.

Valdez Container Terminal: The City of Valdez expanded Ammunition Island to construct a container terminal. It is a complete general cargo facility with a 700-foot by 100-foot floating concrete dock with -55 feet MLLW at the face and mooring dolphins to accommodate ships up to 1200 feet in length. It lies adjacent to a 21-acre marshalling yard with container parking for up to 560 40-foot containers. The parking area is equipped with 380 electrical outlets for containers requiring refrigeration or heat. The floating dock is connected to the marshalling yard with two 200-foot by 27-foot steel ramps. The container terminal is accessible to the mainland by a 1500-foot trestle and an 1800-foot causeway. Long-range plans include development of an additional 120 acres near the marshalling yard as a warehousing and staging area. The city has constructed export grain facilities.

Valdez Small Boat Harbor: The Valdez Small Boat Harbor, a public facility of the city, currently has berthing space for 346 commercial and pleasure boats ranging from 16 to 60 feet in length. City provided water and electrical service are available at each slip. Currently underway


MINERAL CREEK
DOWNTOWN VALDEZ
Valdez City Dock
Chevron Petroleum Dock
Valdez Small Boat Harbor
Valdez Container Terminal Site
AIRSTRIP
OLD VALDEZ
VALDEZ GLACIER STREAM
Crowley Barge Dock
V A T S Barge Dock
PORT VALDEZ
Barge Dock Site
Dock Site
Allison Point
DAYVILLE ROAD
ALYESKA MARINE TERMINAL
SOLOMON LAKE
ALLISON LAKE
ABERCROMBIE CREEK
ROBE LAKE
LOWE RIVER
RICHARDSON HIGHWAY
N
0
1
2
3
4 miles
SCALE 1" : MILE

MARINE FACILITIES



World's largest floating general cargo dock at the Port of Valdez, Alaska in the foreground with adjoining Valdez Gateway Distribution Center and commercial airport.

PORT of VALDEZ
General Cargo and Container Facility: General Information

Owner and Operator: The City of Valdez, Alaska

Location: Mineral Creek Loop Road, Valdez

Berth Information:

Number of Berths: 1

Overall Length: 700 ft. (212.3 m)

Apron Width: 100 ft. (30.3 m)

Deck Height from Water: 14 ft. (4.2 m)

Water Depth: 50 ft. at mean low tide (15.2 m)

Construction: Prestressed concrete floating dock. Two, 200 ft. (60.7 m) ramps leading from the dock to the marshalling yard.

The dock is designed as a multi-purpose berth, to handle containerized, roll-on/roll-off and lift-on/lift-off operations. Crane rails are 90 ft. (27.3 m) gauge.

Area Dimensions:

Total Area: 21 acres (8.5 hectares)

Wharf Area: 70,000 sq. ft. (6,300 sq. m)

General Cargo Storage Area: 840,000 sq. ft. (75,600 sq. m)

Container Storage Capacity: 560 40 ft. (12.1 m) vans and 360 dual reefer outlets. Twin two-lane truck access bridges provide a connection between the floating terminal facility and the storage area.

Container/Cargo Handling Capabilities:

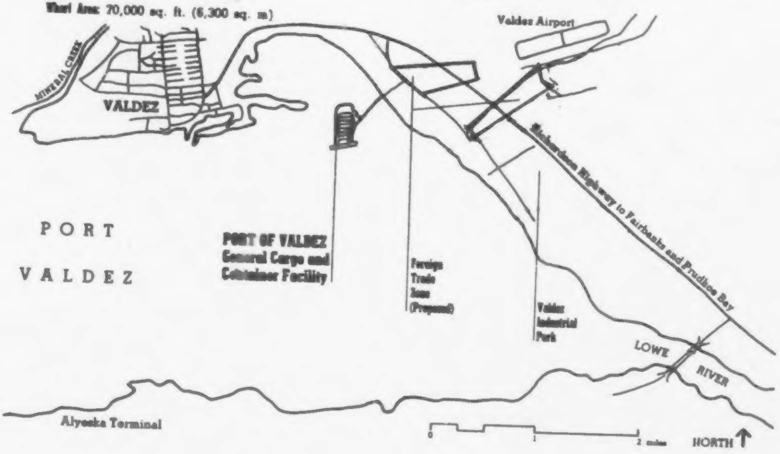
Skippers and carriers have a choice of several cranes, forklifts, tractors and other materials-handling equipment.

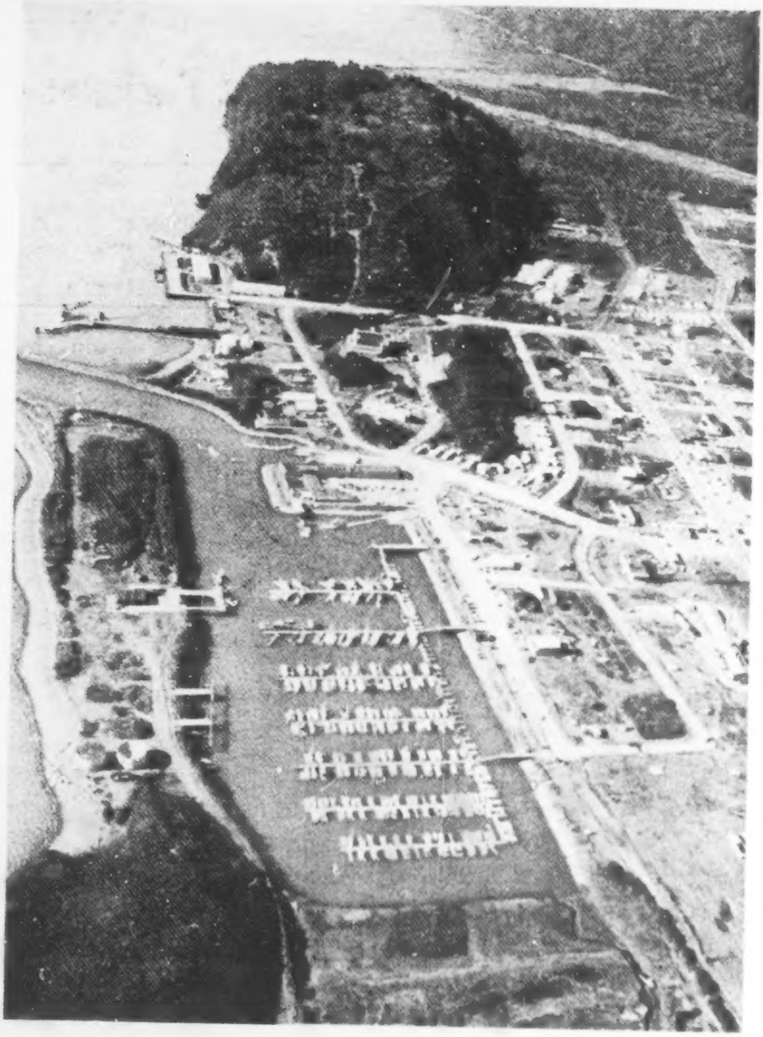
Scale Specifications:

60-ton Fairbanks certification scale is located at the entrance to the terminal.

Stevedoring Services:

The City of Valdez has a contract with the North Star Terminal and Stevedore Co. to provide these services. North Star has more than 30 years experience operating in Valdez.


Valdez Airport
MINERAL CREEK
VALDEZ
Richardson Highway to Fairbanks and Prudhoe Bay
PORT
VALDEZ
PORT OF VALDEZ
General Cargo and
Container Facility
Foreign
Trade
Zone
(Proposed)
Valdez
Industrial
Park
LOWE
RIVER
Alyeska Terminal
0
1
2 miles
NORTH



is the dredging of the east end of the harbor which will expand the usable area by approximately 150 berths.

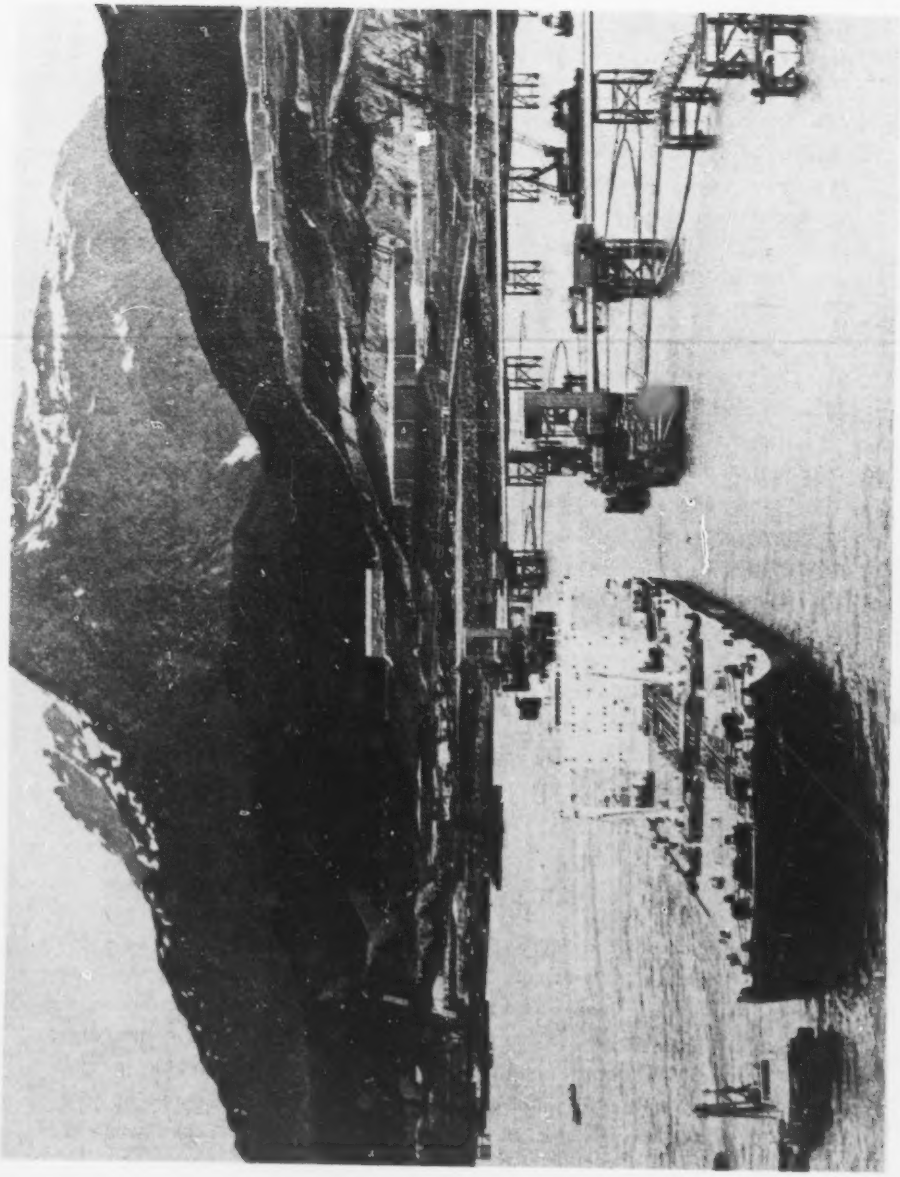
The City plans to add a commercial boat harbor east of the Small Boat Harbor and west of the new container terminal. The new area would be dredged to about -25 MLLW to accommodate vessels up to 300 feet long. The proposed commercial boat harbor is also the potential site of the new Alaska State Ferry Terminal.

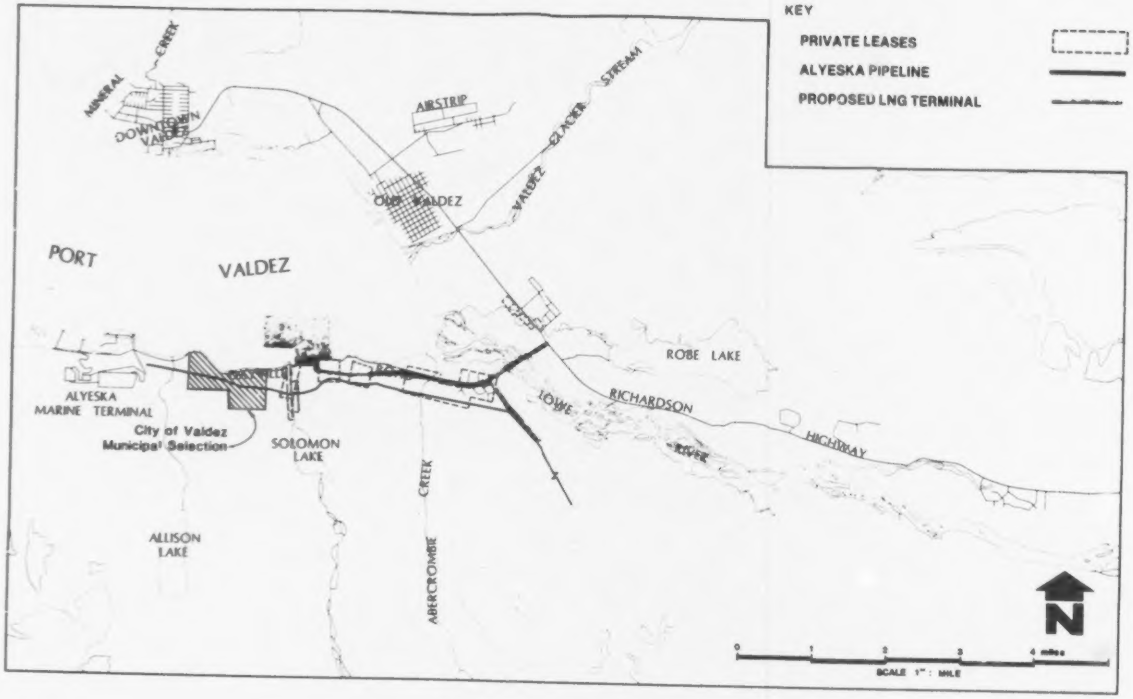
U. S. Coast Guard Dock: The dock, with -12 MLLW, is located at the northwest end of the entrance to the Small Boat Harbor.

Valdez Dock Company: This dock is located between the city dock and the Valdez Small Boat Harbor. The dock serves as home port for the M/V Alaska Standard which delivers products to users in Prince William Sound, Western Alaska, and other coastal communities to the south and to the west.

Barge Docks: Two infrequently used docks next to each other in the old townsite area serve barges equipped to bottom-out at low tide. The northwesterly dock is owned by Crowley Maritime Corporation; the adjacent dock is owned by Valdez Alaska Terminals (VAT), a subsidiary of Alaska International Industries, Inc., and is somewhat larger with deeper water alongside. It includes a 10-acre laydown area which abuts the city's Industrial Park.

Valdez Marine Terminal: The largest installation is the Alyeska Marine Terminal, terminus of the trans-Alaska pipeline. The terminal has four berths, three trestle pier structures, which extend offshore and handle tankers up to 285,000 dead weight tons, and one floating berth anchored to bedrock onshore which handles tankers up to 120,000 dead weight tons. Traffic averages slightly less




KEY
PRIVATE LEASES
ALYESKA PIPELINE
PROPOSED LNG TERMINAL
MINERAL CREEK
DOWNTOWN VALDEZ
AIRSTRIP
VALDEZ GLACIER STREAM
OLD VALDEZ
PORT VALDEZ
ROBE LAKE
LOWE RIVER
RICHARDSON HIGHWAY
ALYESKA MARINE TERMINAL
City of Valdez Municipal Selection
SOLOMON LAKE
ABERCROMBIE CREEK
ALLISON LAKE
N
0
1
2
3
4 miles
SCALE 1" : MILE

EXISTING RIGHTS-OF-WAY

than two ship arrivals per day. Between August 1, 1977, and November 8, 1983, 4000 tankers called at the Alyeska Terminal.

Special Harbor Consideration: The U. S. Coast Guard handles tanker traffic in Port Valdez from a Marine Safety Office facility. The Prince William Sound Vessel Traffic System is a highly sophisticated control network which blankets the Sound. Equipped with radar and television, the facility also has a VHF/FM microwave relay communications system which allows contact with all vessels from three hours out of port. Fifty-two personnel are stationed at the Marine Safety Office with two persons on watch and one officer on duty 24 hours per day, year-round. Backup and emergency generators at all remote communication sites plus the control center ensure uninterrupted operations. Using current traffic schemes, the Coast Guard estimates the port could safely handle 30 daily transits, nearly a tenfold increase over present use.

Several potential dock locations have been identified and studied to varying degrees (including bathymetry, soils and geotechnical investigations) for the shipping of liquid petroleum products. Of these locations, sites in the vicinity of Allison Point and Solomon Gulch on the south shore of Port Valdez appear to be the most attractive. In addition, there is the potential for adding a liquid product's dock adjacent to or in the vicinity of the container terminal. In general, any major new facility would be restricted (by geotechnical constraints, land tenure, and desires of the city) to areas between Gold Creek and the new container terminal on the north shore and between the Alyeska Marine Terminal and Solomon Gulch on the south shore of Port Valdez. (Additional sites such as Gravina Bay do have siting potential but do not have complete geotechnical and feasibility studies that exist for our proposed Valdez Industrial Park site.)

One of these locations, Allison Point on the southeastern shoreline west of the Dayville Flats area, is considered one of the more desirable potential deepwater dock sites due to ease of access and availability of shoreline property selected by the City of Valdez under its Municipal Land Entitlement. Currently there are several near-shore private leases in the area, as well as a right-of-way for the Alyeska pipeline. In addition, Alaska Oil Company was granted a right-of-way for a products pipeline from the intersection of the Richardson Highway and Dayville Road to the Solomon Gulch site. Area exists for a similar right-of-way to the Allison Creek site. These leases and rights-of-way as well as the municipal land selection are shown on the following map.

Physical Oceanography and Bathymetry

Port Valdez, 12 miles long and 3.4 miles wide, is a glacial fjord with steep sides on the north and south, and a nearly horizontal bottom which is 787 feet deep over approximately three-quarters of its length. The bottom rises rather uniformly in the easternmost quarter to the shore at the former townsite area. Silt deposition at the mouths of Valdez Glacier Stream and the Lowe River in the southeast corner of Port Valdez has contributed to the formation of a shallow delta there. The maximum depth of the port is in the southwest corner where it is 810 feet deep. The overall mean depth is about 590 feet. At Valdez Narrows, entrance to Port Valdez, a shallow sill with a maximum depth of 525 feet limits the direct exchange of water below that depth of Port Valdez with the deep waters of Prince William Sound. Oceanographic conditions of Port Valdez are affected by weather fronts, wind, and runoff, as well as tidal exchange.

Tides and Currents

The tides in Port Valdez are mixed, semi-diurnal with an average range of 12 feet, and extreme high of +16.5 feet and an extreme low of -6 feet.

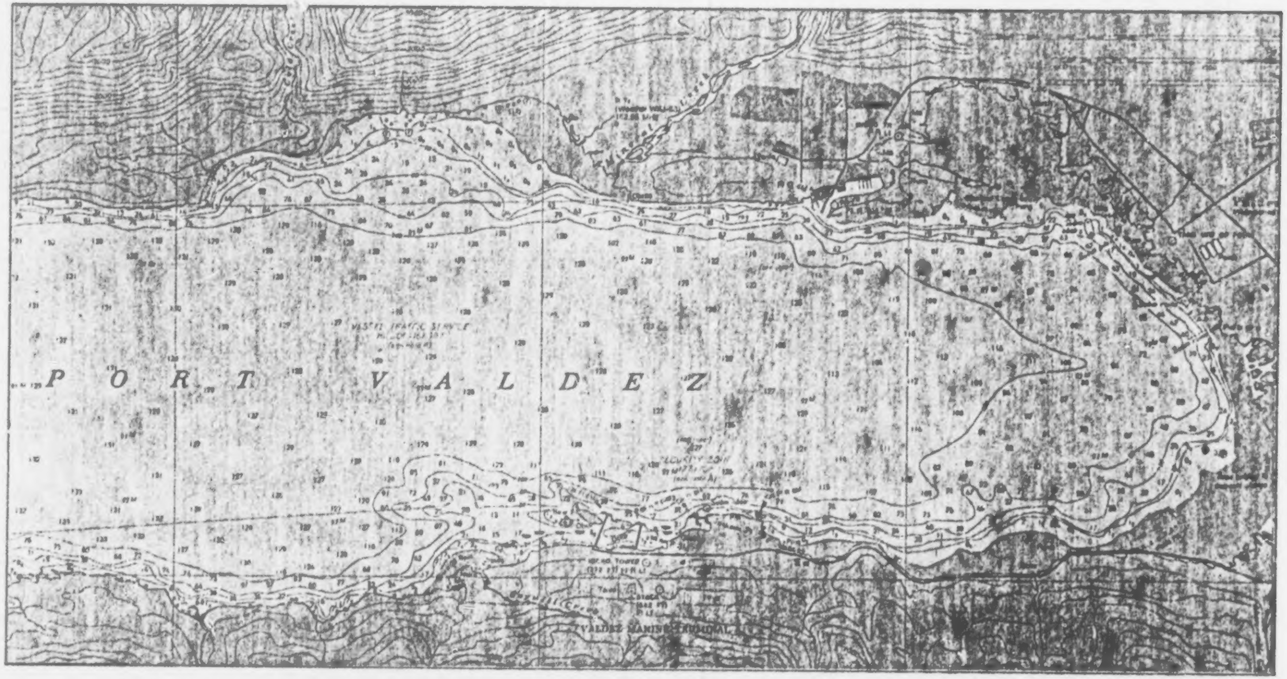
The flushing capacity of Port Valdez seems to be due to fresh-water advective flows in the summer, and large weather-related exchanges of water during the rest of the year. Indications are that significant flow events at Valdez Narrows, possibly caused by storm-induced barometric pressure variations, are instrumental in the flushing of the port. The present knowledge of the physical oceanography of Port Valdez is not adequate to provide a detailed understanding of the water movements through the port. Further studies likely would be necessary before a permit to discharge wastewater would be issued by the state and federal governments.

Ice Conditions and Other Marine Consideration

The only conditions which could affect vessel traffic in Port Valdez are wind and floating icebergs calved into the Sound by Columbia Glacier southwest of Port Valdez. These conditions actually have affected traffic rarely; twice in 1980, a ship maneuvered slightly to aviod floating ice, and perhaps a dozen times in the past three years a vessel has awaited calmer weather at the Knowles Head anchorage north of Hinchinbrook Island before continuing into port. There have been no weather-related tanker traffic incidents relative to Alyeska traffic since that facility began operation in August 1977.

The U. S. Coast Guard considers winds in excess of 40 knots to pose a potential hazard to ships at berth and carefully evaluates any transit in winds above that speed. in addition, transits are evaluated independently by the Master of the tanker as well as by the Alyeska Terminal controllers, and any one of the three can decide the ship will await calmer weather at Knowles Head rather than attempt berthing as scheduled.

Ice from Columbia Glacier has not adversely affected vessel in Prince William Sound to date. Predictions in 1980 by the U.S. Geological Survey that the rate and magnitude fo calving would increase significantly in the next few years have prompted a hazard watch of the glacier which includes radar surveillance and studies continue in order to refine predictions. The possibility that an iceberg could enter traffic lanes unnoticed seems extremely remote.


P O R T V A L D E Z

SOUNDINGS IN FATHOMS U.S. Department of Commerce
(Fathoms and Feet to 11 Fathoms)

INFRASTRUCTURE

City Administration

The City of Valdez is a home-rule city, with a city manager/council form of government with a mayor as chairman of the council and a city manager as the chief administrative officer. Council members are elected to two-year terms and the mayor is elected to serve a one-year term. The city staff includes about 90 persons in the following departments: Administration, Port, Engineering, Parks and Recreation, Community Development, Police, Fire, Emergency Medical Services, Public Works, Mental Health, Library and Civic Center.

In addition to the above departments, a number of commissions and advisory boards provide input into the administration of local government in Valdez, including the Planning and Zoning Commission, Transportation Commission, Parks and Recreation Commission, Community Health Commission, Mental Health Advisory Board, City Library Board and Heritage Board.

City Finances

With a tax base of more than $1.6 billion and a population of just under 4000, the City of Valdez has one of the highest per capita assessed valuations in the country.

Because of this tax base, the city has been able to build over $100 million in improvements to the city's infrastructure during the past five years while maintaining an equitable tax rate as compared to other cities in Alaska and in the Lower 48.

The city has experience in the field of tax-exempt industrial development bond financing as it used its bonding authority to assist the major oil company owners of the trans-Alaska pipeline in issuing $1.36 billion in tax-exempt municipal bonds for the Valdez Marine Terminal. This relationship worked well for the city as well as the oil companies in that the city was able to create a $13.6 million Permanent Fund with its 1% share of bond proceeds. The interest earnings from this fund help the city maintain lower property tax rates.

As a result of our past experience with issuing tax-exempt municipal bonds for industrial development projects, the city stands willing to assist other industries locating in Valdez with similar financing.

Population

The population of Valdez was 3694 in a September 1982 census and housing inventory. While the population of Valdez fluctuated considerably in the period between 1970-78 due to construction of the Alyeska pipeline and marine terminal, the city's permanent population has begun to stabilize. Valdez grew from a town of 1000 people in 1970 to a boom town of 8000 by mid-1976. Following completion of the Alyeska project in 1978, a substantial out-migration began resulting in a reported population of 3349. Since that date, the community has grown at a rate of six percent or approximately 251 persons per year. The City of Valdez is currently updating the 1982 census and housing survey. These figures should be available in the very near future. As in many other communities in Alaska, the population of Valdez is higher in the summer than in the winter. Several construction projects including a new 132-room hotel, a new fish processing facility, a National Guard Armory and completion of the city's Small Boat Harbor expansion project could induce the in-migration of approximately 125 non-resident construction workers in the summer of 1984.

The 1982 census found that males comprised 52.7 percent of the total population, females 47.3 percent, and that 63.8% of the population is of working age. Recent school enrollment trends indicate a gradual shift in the age/sex composition of the community toward national norms, with fewer single male individuals and a higher proportion of family units appearing in the post-pipeline construction period.

Valdez Population Forecast

Year	Annual Growth of 3.75%	Total
1982	3694	3694
1984	138	3832
1985	143	3975
1986	149	4124
1987	154	4278
1988	160	4438

Employment and Economic Base

Prior to construction of the trans-Alaska pipeline and Alyeska Marine Terminal, the economy of Valdez consisted of government work (61 percent), wholesale and retail trade (20 percent), transportation (5 percent) and services (8 percent). Although government is still the leading employer in Valdez, local employment in construction, transportation and retail trades has assumed greater prominence. A current estimate of employment by industry follows:

Valdez Employment by Industry

Industry	Number	Percent
Construction	236	12.8
Transportation*	307	16.4
Communication/Utilities	43	2.5
Wholesale Trade	11	0.5
Retail Trade	276	14.8
Fisheries	273	14.7
Finance, Insurance, Real Estate	33	1.0
Services	112	6.0
Education	121	6.5
Government		
Federal	95	5.1
State	261	14.0
Local	93	4.9
Total	1861	

* Includes Alyeska Marine Terminal employees

Valdez is taking steps to assume a greater role in the development of Alaska's transportation and fisheries industries. In 1978 the voters of Valdez approved a $48 million bond issue for construction of a new port. The Valdez Container Terminal, completed in 1982, enables Valdez to once again become a major port serving Interior Alaska. The city also is striving to expand its role in the fisheries industry through construction of capital improvements and participation with private industry interests. Design of a commercial boat harbor, the current expansion of the existing small boat harbor, and the construction of a third fish processing plant are projects currently underway.

Transportation Systems

The principal component of the Valdez road system is the

Richardson Highway, which connects Valdez to Glennallen and Fairbanks to the north and intersects with the Glenn Highway from Anchorage at Glennallen. North of Gulkana at Mile 130, the Richardson Highway connects with the Tok cut-off which leads to the Alaska Highway. Travel distances on the Richardson from Valdez are 120 miles to Glennallen, 365 to Fairbanks, 305 miles to Anchorage and 258 miles to Tok. The Richardson is a paved, two-lane highway which has been and remains the subject of extensive repaving and upgrading.

The Richardson Highway had an average daily traffic (ADT) in 1978 of 5200 in central Valdez and an estimated hourly capacity of 1700 vehicles in both directions. Volumes in 1978 declined to 4325 ADT at Mile 7 beyond Dayville Road, and 1600 ADT at Mile 17, Keystone Canyon. Trucks accounted for 12.5 percent of traffic close to Valdez and 18 percent east of Dayville Road. Traffic volumes in Valdez are expected to increase at the pre-pipeline rate of about three to five percent per year (or 2100 ADT) for all vehicles. These increases would not materially affect the capacity of the highway.

The Valdez Airport, located approximately four miles east of downtown, is owned and maintained by the Alaska Department of Transportation and Public Facilities. Its estimated capacity is 100,000 to 200,000 flight operations per year which far exceeds its current level of use.

The airport's 5000-foot runway has been extended to 6500 feet and widened to 150 feet. Additional improvements include runway and taxiway lighting, a rotating beacon, and a lighted wind cone. An LDA/DME/NDB (Localizer type Directional Aid with Distance Measuring Equipment) system was installed in 1979 to provide more reliable air service,

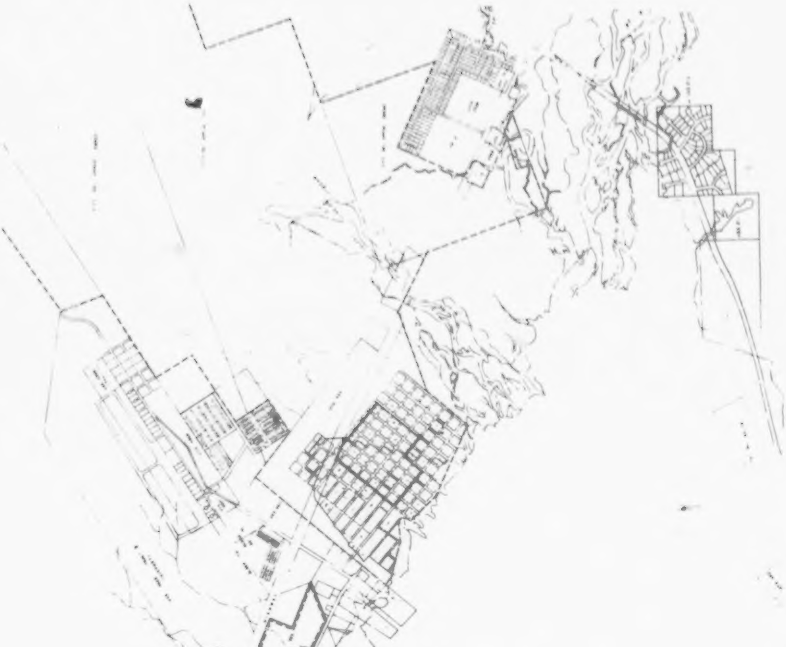
and in 1983 the world's first FAA commissioned Microwave Landing System was installed which increases the airport's reliability factor to 97%.

Three air carriers provide scheduled service between Valdez and Anchorage. Two carriers use twin-engine aircraft most of which carry eight to nineteen passengers; the third airline utilizes a 50-passenger, four-engine aircraft when weather and loads require. Corporate jet aircraft also frequently use the airport.

The Alaska Marine Highway system provides ferry service to Valdez and five other cities. The M/V Bartlett, operating twice weekly between Valdez and Whittier, has a capacity of 170 passengers and 38 standard passenger vehicles. The Alaska Railroad transports passengers and vehicles between Whittier and Anchorage. The Bartlett carries most of its traffic in June, July and August, when it frequently operates at capacity. Since most of the passengers are tourists who have reserved space long in advance, little opportunity exists for local residents to use the ferry. The M/V Tustemena calls at Port Valdez once weekly on its Cordova to Seward route.

Valdez Foreign Trade Zone

The City of Valdez is currently applying to the Federal Government for a license to operate a Foreign Trade Zone. As shown in the following table, a portion of the Industrial Park will be included in the proposed Foreign Trade Zone. The Foreign Trade Zone areas and acreage are outlined as follows:


LEGEND
FOREIGN TRADE ZONE
INDUSTRIAL PARK
PORT VALDEZ BAY SCALE 1"=1000'
N

Area	Acreage
City Dock and Marshalling Yard	1.3
Small Boat Harbor	27.0
Valdez Container Terminal and Marshalling Yard	29.0
ATS 11 - Causeway Marshalling Yard	60.0
Pipeyard USS 439	82.5
TOTAL ACRES	205.30

Approval for the operation and maintenance of Valdez Foreign Trade Zone is anticipated in 1984.

The benefits available through the use of foreign trade zones in America are just becoming recognized by the commercial/industrial community. It has been estimated that by 1985 free zones, which is a global generic term for what we in the U.S. refer to as foreign trade zones, may be handling more than 20 percent of worldwide trade.

Valdez has a good geographic location for product distribution in Alaska as well as access to international markets indicating that its future as a foreign trade zone will be successful.

Schools

Excellence in education is and continues to be Valdez City School's theme. The School Board continually strives to improve its ability to provide a quality education to all students regardless of the student's ability. The district is primarily a high academic program with a sound basic program in the vocational trades. The district has begun an intensive computer training program at all grade levels and is looking to add a computer component to its graduation requirements.

The district requires all students to pass thirteen required subjects and an additional eight electives to be determined by the student's interests and career goals for a total of 21 out of a possible 24 units for graduation.

The programs are highly individualized at all grade levels with a district curriculum which prepares students at four different levels: Primary (K-2), Middle School (3-6), Junior High (7-8) and Senior High (9-12). The curriculum is yearly evaluated and the district plans to introduce student proficiency criteria at all grade levels and a teacher competency plan in 1983-84.

Achievements received by Valdez City Schools include the following:

1. Language Arts Handbook - 1981
2. Human Resource Directory - 1982
3. Business Office Simulation Systems - 1982
4. Battle of the Books - 1983
5. Attendance Monitoring System - 1982
6. Post Secondary Information Card - 1983
7. Enrichment Class History of Science - 1983
8. U.S. Office of Education Award for Excellence at the Secondary School - 1983

The upper level schools are accredited. The High School was accredited in 1971, the Junior High in 1981. The two elementary schools are planning for an accreditation review in 1984.

The City of Valdez and School Board bonded themselves to provide the most up-to-date facilities to house the excellent programs.

Since 1975 the district has built a new high school, two elementary schools and upgraded the other existing facilities. The current enrollment is approximately 740 regular students and 90 severely retarded and profoundly handicapped students on a residential program. The facilities for the regular students accommodate approximately twice that number for a total accommodation of 1400 students with minimal modifications.

The school staff is of the highest caliber with constant demand for improvement of instruction with the latest technology in teaching techniques.

The community has looked into the future in planning of facilities and programs. Long-range plans have been established, and the community schools will provide for the needs of all children.

Prince William Sound Community College

Prince William Sound Community College was established in July 1978 as a member of the University of Alaska network. It currently has an enrollment of 1000 students with a full-time faculty of eight and part-time faculty of 45. The college offers an Associate of Arts degree which is a generic transfer program to four-year college programs. In addition, the college offers an Associate of Applied Science degree in office occupations and developmental disabilities with certificates in both programs. Credit courses are offered in a variety of vocational programs including welding, fisheries, hydraulics, mechanics and business administration. The college also offers dormitories, day care for married students, consortium library, shop and vocational training facilities with state-of-the-art equipment and a full range of counseling services. An $8.5 million classroom and office building is planned for 1985-86 construction.

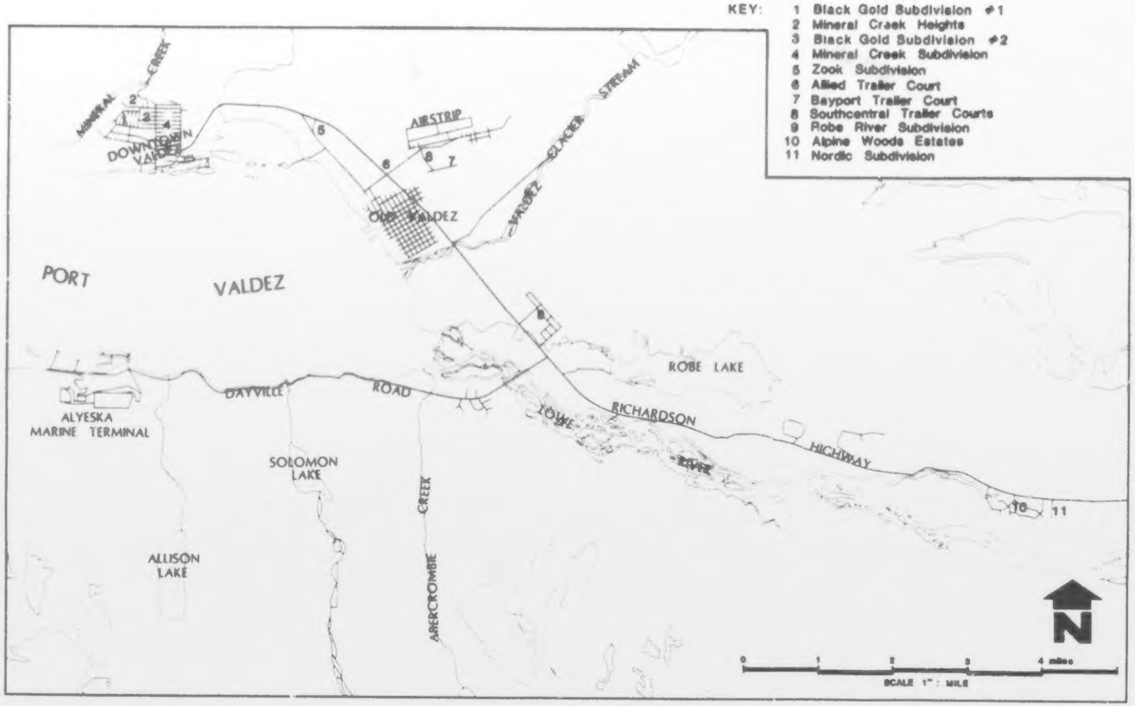
Housing

A survey in September 1982 counted 1345 housing units in Valdez. Mobile homes comprise about 38% of the housing, but the trend is toward replacing them with permanent structures. Single-family units also comprise about 38% of the housing, and multi-family units about 19%. Following is the breakdown of dwelling unit types tabulated in the 1982 survey.

Valdez Housing Data

Type	Total Units	Occupied Units	Vacancy Rate	Population	Unit Percent
single-family	518	476	8.1	1596	38.5
Duplex	59	56	5.1	142	4.3
Tri-plex	12	12	.0	37	.8
Four-plex	63	60	4.8	147	4.6
Multi-unit	123	88	28.5	189	9.1
Mobile	514	460	10.5	1331	38.2
Trailer	56	55	1.8	97	4.1
Group	--	--	--	145	.4
	1345	1207	10.3	3694	100.0

A 1978 housing inventory counted 970 occupied housing units, with slightly more than half of all units being mobile homes. Single-family housing units then comprised 20%


KEY:
1 Black Gold Subdivision #1
2 Mineral Creek Heights
3 Black Gold Subdivision #2
4 Mineral Creek Subdivision
5 Zook Subdivision
6 Allied Trailer Court
7 Bayport Trailer Court
8 Southcentral Trailer Courts
9 Robe River Subdivision
10 Alpine Woods Estates
11 Nordic Subdivision
MINERAL CREEK
DOWNTOWN VALDEZ
AIRSTRIP
VALDEZ GLACIER STREAM
OLD VALDEZ
PORT VALDEZ
ROBE LAKE
RICHARDSON HIGHWAY
LOWE RIVER
DAYVILLE ROAD
ALYESKA MARINE TERMINAL
SOLOMON LAKE
ABERCROMBIE CREEK
ALLISON LAKE
N
0 1 2 3 4 miles
SCALE 1" : MILE

PRIMARY RESIDENTIAL AREAS

of the total and multi-family units 16%. Mobile homes still constitute a major dwelling type; indications are that conventional housing units will continue to represent an increasing percentage of the housing market.

Building permits were issued for 44 homes in 1983. A few speculative homes currently are under construction, and considerable interest by contractors has been indicated for the coming season. Currently, most houses are being built with an owner-builder contract. The average price of a newly-constructed single-family house is approximately $120,000. Prices for previously occupied homes start at approximately $100,000 and used single-wide mobile homes sell for approximately $25,000. Mortgage money is readily available in Valdez at prevailing Alaska interest rates.

Average monthly rent for a typical two-bedroom frame unit is approximately $650. A typical two-bedroom mobile home unit rents for approximately $600 per month, excluding space rent and utilities.

Most homes in Valdez are heated using fuel oil. The current cost of Number 2 fuel oil delivered in Valdez is about $1.18-$1.23 per gallon, which is comparable to prices in Anchorage and Fairbanks.

Community Expansion Potential

Developed land within the City of Valdez could more than double in area, and the population could expand to 13,000 without changes in land status and classification.

There is a potential of 675 platted, undeveloped residential lots currently available, although road improvements are required in some areas. An additional 1125 residential lots could be subdivided from existing undeveloped state land that has residential capability.

Realizing that the growth projected for Valdez in the next decade will require the timely development of new residential land, the city selected 640 acres west of the new townsite under its Municipal Land Entitlement. The West Mineral Creek area is scheduled for beginning development in 1984, with soils analysis and preliminary subdivision design. The construction of the West Egan Street extension and bridging of Mineral Creek were completed in 1983. Given a balanced mix of residential densities, open space and community facilities, this new development could eventually house some 5000 persons.

As of September 1982, 427 vacant trailer spaces were counted in the Allied, Bayport, Southcentral, Simmons, Johnson and Acres trailer courts.

There are 176 acres of commercially-zoned, undeveloped property in the new town and Zook Subdivision areas.

In addition, there are 3215 undeveloped acres, including Tract B, within the City of Valdez Industrial Park and municipal industrial property in the east Dayville Road area.

Electricity

Electrical power in Valdez is provided by the Copper Valley Electric Association (CVEA). This Association provides power to Valdez and Glennallen through a 125-mile long transmission intertie. There are generating facilities both in Glennallen and Valdez with a total installed capacity of almost 30,000 megawatts (mw).

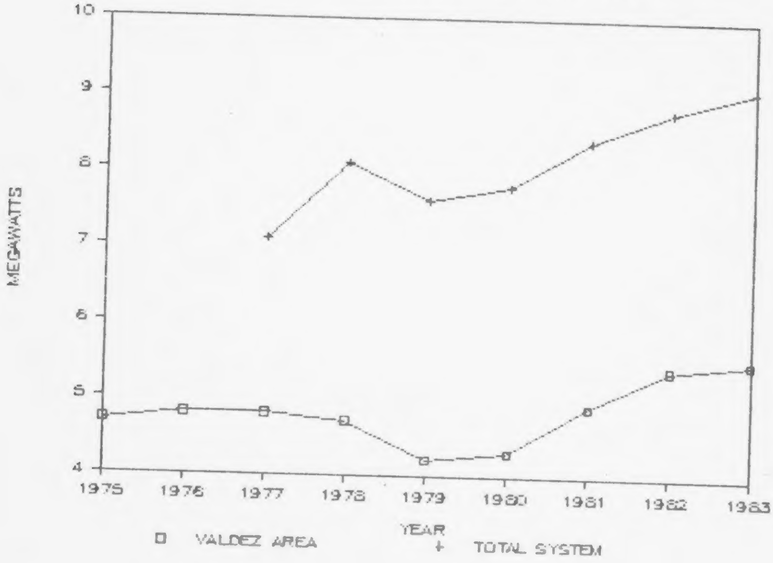
The generating facilities in Valdez consist of a hydroelectric plant at Solomon Gulch with two 6-megawatt turbines, six diesel engine generators and one diesel turbine generator. The Valdez facilities provide 13.5 megawatts firm power during the spring and summer months and approximately ten megawatts firm power during the winter. This variation is due to a lower availability of water during the winter months for hydroelectric generation.

The facilities in Glennallen consist of seven diesel-fired generators with a total installed capacity of 7.4 megawatts and firm power of 4.9 megawatts. The total system including both Glennallen and Valdez has 19 mw firm power available in the summer and spring months and 15.5 megawatts in the winter.

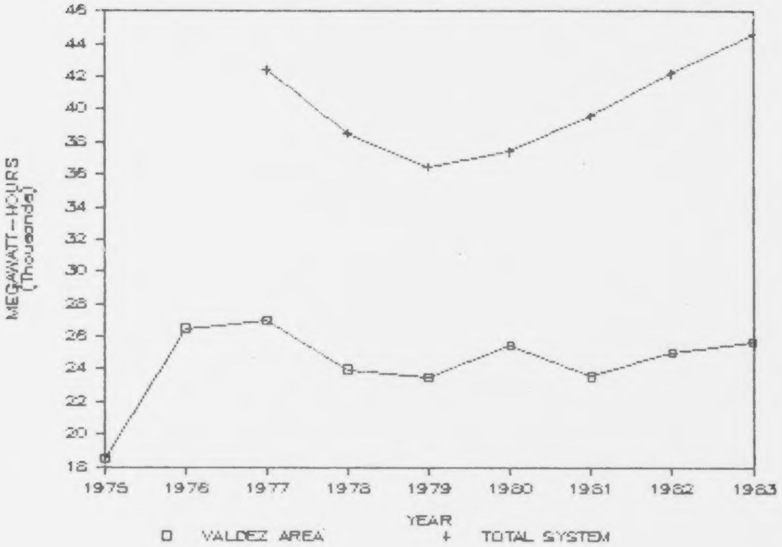
Megawatt-hour sales for the total service area have increased from 37,500 megawatt hours in 1979 to 44,500 megawatt hours in 1983. The peak demand for the entire service area has varied from approximately 7.6 mw in 1979 to approximately 9.1 mw in 1983. During 1983 the monthly megawatt-hour sales for the Valdez portion of the system have ranged from a low of approximately 2000 megawatt hours in May to a high through November of 2742 megawatt hours in November 1983. Monthly peak demands for the Valdez area for 1983 through November have ranged from 4.0 megawatts in June to a high of 5.2 megawatts in November.

Future improvements proposed for the system include raising the spillway on the Solomon Gulch dam by three feet to provide better firm power during the winter months.

PEAK POWER DEMAND



TOTAL ENERGY CONSUMPTION



Hydroelectric facilities have been proposed and some investigation done on Allison Lake and Silver Lake sites. Provisions were made during the trans-Alaska pipeline construction for installation of a turbine in the pipeline which would be capable of generating in excess of five megawatts.

Water System

The current Valdez municipal water system is divided into four independent systems. The downtown area is served by a major distribution system. This system is fed from four wells with a total pumping capacity of 6.6 million gallons per day (mgd). The current average daily usage is approximately 1.6 mgd. This system also includes two 700,000-gallon reservoirs for a total storage capacity of 1.4 million gallons. The other three systems are independent and have a capacity of from .35 to .5 mgd. One of these systems, the Loop Road system in the area of the new port facility, has a 500,000-gallon reservoir. The water system in the outlying Robe River Subdivision has a 420,000-gallon reservoir.

The Valdez area is characterized by the availability of large amounts of high-quality subsurface water.

A test well was drilled in the area of the Valdez Industrial Park. This 12-inch well was test pumped in 1979 for approximately two days at the rate of 1550 gallons per minute. During the pumping a water table drawdown of approximately four feet was measured in an observation well approximately 75 feet from the well being test pumped. The water at the test well was approximately 18 feet deep and varies in the area generally from two feet to 112 feet in depth.

Municipal Waste Water

The City of Valdez operates a municipal waste water treatment plant located in the center of the old Valdez townsite. Since 1976 the facility has consisted of a three-pond lagoon system including two aerated ponds. The rated capacity of the plant is 1.25 mgd. The treatment plant currently receives flows varying from .5 mgd during the dry periods of the year to 1.0 mgd during the wetter months. The plant has no trouble meeting its permit requirements of 80 percent BOD and suspended solids removal.

The city provides sewer service to all the new town site, the airport and adjacent trailer parks, and to the Zook Subdivision. The colleciton system could be extended to serve the Valdez Industrial Park area.

Solid Waste

The City of Valdez opened a new sanitary landfill north of the Richardson Highway in 1981. There is sufficient area to serve the needs of the City of Valdez for at least ten to fifteen years.

Telephone

Installation of new electronic switching equipment in Valdez by the Copper Valley Telephone Cooperative in 1977 eliminated the local and long-distance telephone problems which were experienced during construction of the Alyeska pipeline and terminal. Existing equipment has a capacity of 2500 lines, and when necessary, capacity can be increased by the purchase of additional equipment available with about four months lead time. The system can add 2000 lines without any major equipment addition.

Fire Department

The Valdez Fire Department supports four well-equipped fire stations with a staff of 13 full-time professionals supported by a volunteer force of approximately 60 persons, many of whom are Emergency Medical Technicians. The fire department sponsors a number of educational programs ranging from the teaching of basic safety practices to school children, to industrial first aid classes and Emergency Medical Technician certification programs. All are open to the general public. The Department also is committed to a program designed to further reduce response times, lower fire insurance ratings in the various districts within the city, and increase public awareness about general fire hazards.

Police Department

The Valdez Police Department includes 14 officers and five dispatchers. The department operates three shifts per day, with two patrolmen per shift. The department has a modern jail facility with an overnight capacity of nine occupants, and a potential to hold 16. The department is well-equipped, and at its present staffing level can handle a population increase of 1500 persons. In addition to the local police, one Alaska State Trooper and two enforcement officers of the Alaska Department of Fish and Game are stationed in Valdez.

Emergency Medical Service

Emergency medical response capability is provided through the Valdez Fire Department. All 13 full-time department staff members are trained Emergency Medical Technicians, and many of the city's volunteer firemen also are EMTs. A full-time Emergency Medical Services Director supervises fire department and volunteer training programs, and serves as Assistant Fire Chief.

The fire department has two ambulances, one stationed in town and one at the 10 Mile Station. The Valdez Community Hospital has an emergency room staffed 24 hours a day with a registered nurse and physician on call.

Valdez Community Hospital

The city supports a well-equipped, well-staffed, 15-bed hospital which was built in 1967 in conjunction with the state's Harborview Developmental Center for the physically and mentally disabled. The hospital has nine patient rooms, an X-ray room, delivery room, nursery, surgery suite, anethesia room, emergency room and clinical laboratory facility.

The hospital staff consists of seven registered nurses, seven nurses aides, and a trained medical technologist and a radialogical technologist. Three full-time physicians support the hospital facility with one doctor on call 24 hours a day.

Minor surgery is performed at the hospital, but major surgery and extreme emergency cases are airlifted for treatment in Anchorage. Various health care specialists visit Valdez on a recurrent basis.

Private Medical Care

Three resident physicians, a dentist, optomotrist, and a chiropractor serve Valdez. Other specialists, including an ear, nose and throat doctor and orthodontist, visit Valdez on a recurrent basis.

Valdez Counseling Center

The city supports a full-time counseling center staffed by two professional psychologists. The counseling center offers individual, group and family therapy; marital counseling; medication management, and weight control assistance. Alcohol treatment services are provided through individual and group counseling, referral services, and alcohol education classes. Emergency services include a 24-hour, seven-day crisis line, as well as coordination of services for battered spouses. City-wide educational programs are offered concerning parent effectiveness, mental health, alcohol and drug abuse problems, and suicide prevention.

Valdez Consortium Library

The Valdez Consortium Library supports a current collection of 30,000 volumes and is housed in a new building completed in the summer of 1980. The library serves a dual function as a public and an academic library as agreed upon by the City of Valdez and Prince William Sound Community College.

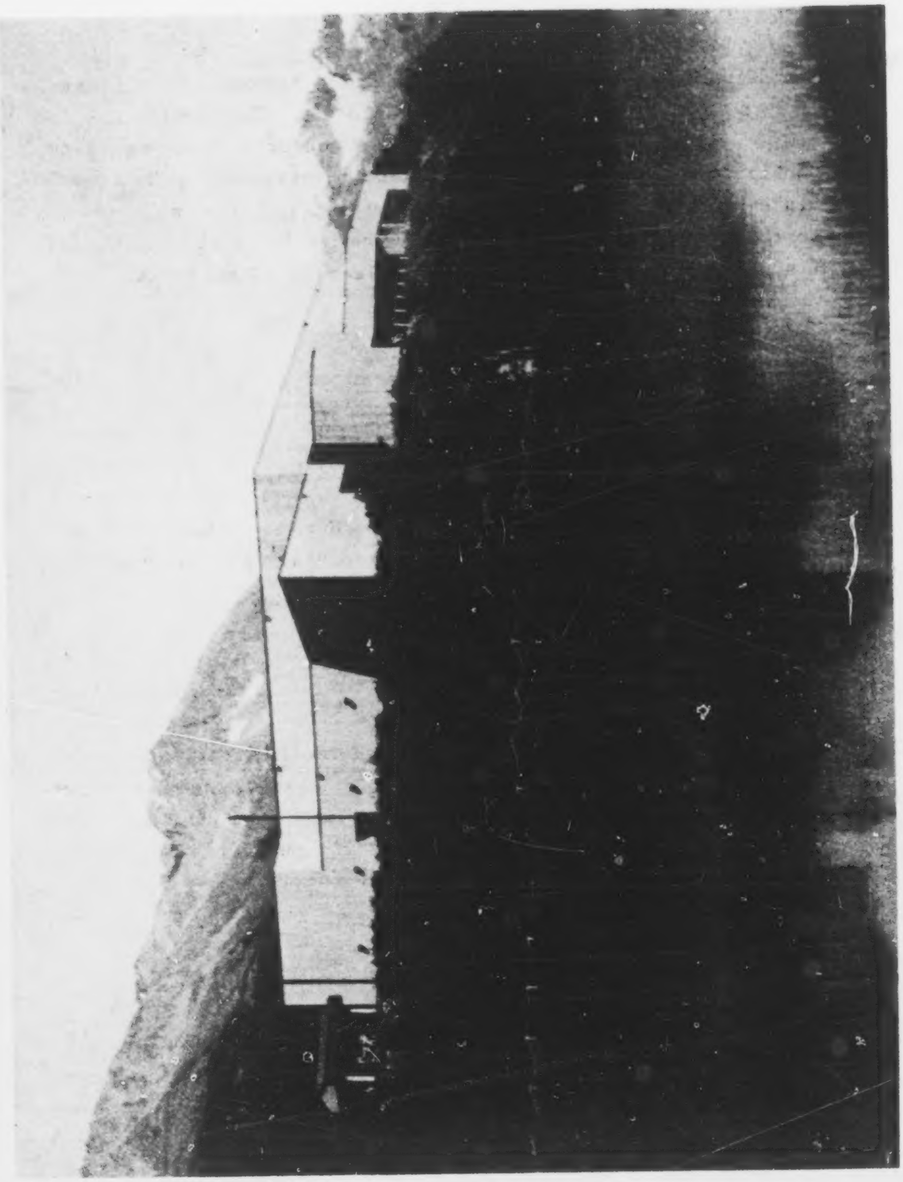
The library offers many non-book media, including microfilm, records, and cassettes, and offers a listening room. The library is a member of the Alaska InterLibrary Borrow System, which enables it to acquire volumes which aren't offered in the city's collection. The library is expanding its collection rapidly, most notably in the reference section and eventually could house up to 50,000 volumes.

Valdez Heritage Center

The Valdez Heritage Center offers an opportunity to learn about the rich local and regional history, from gold rush days through pipeline construction. Housed in the Centennial Building which until the summer of 1980 was shared with the library, the Heritage Center now has twice its former space. The newly remodeled center has an area for display of traveling exhibits as well as an area to display significant current events. In addition to the regular exhibits, the Heritage Center conducts special education programs to mark historic events and offers local history programs within the school district.

Valdez Civic Center

The Valdez Civic Center, completed in the summer of 1982, houses a 500-seat theater with a stage. It also houses a ballroom which is capable of seating 800 theater-style or 500 banquet-style, and a support kitchen and conference rooms. The Civic Center is a catalyst for a greater range of cultural and civic events in Valdez, and provides a setting for statewide conventions. The facility offers programs geared to supplement the existing activities available to Valdez visitors during the busy summer tourist season.



Valdez Council of Arts and Crafts

The Arts and Crafts Council annually brings noted state and national performers to Valdez. Included are a cross-section of dance programs, concerts ranging from popular to classical music, and theatrical productions. Since completion of the Civic Center and the ability to host larger productions, the council is able to expand its program to include a broader selection of performances.

Television

Cable television service in Valdez extends from the downtown area to Robe River Subdivision and offers 11 channels including three all-movie channels, an all-sports channel and an all-news channel. A transponder in Valdez provides reception of one channel of commercial programming via the Alaska Satellite Project.

Radio

Valdez currently has two commercial radio stations. Both stations broadcast 24 hours a day and are owned by major Alaskan broadcasting corporations and affiliated with national networks. An application for a public radio station has been filed with the FCC and is presently being reviewed.

Recreation

The City Parks and Recreation Department provides and maintains a wide range of public-sector recreational programs and facilities, including four neighborhood parks, three special interest parks, a campground, rifle range, new four-diamond softball complex, three little league fields, four tennis courts, four outdoor basketball courts, a newly constructed Teen Center, a Recreation Hall and a small ski tow located at Thompson Pass. In addition to these facilities, the department coordinates with the school district to provide programs for general public use of the Olympic-size swimming pool, pistol range, racquetball courts and gymnasiums.

The department also sponsors year-round programs including swim and dance lessons, league softball, basketball and volleyball, exercise classes, and children's activities; and participates in the sponsorship and coordination of activities such as the annual Winter Carnival and Gold Rush Days events.

The parks and recreation department is currently developing a 10-year master plan which addresses projected recreational needs of the community through a recommended capital improvements program. In conjunction with the community development plan, this effort will ensure the continued availability of high-quality recreational opportunities for Valdez residents throughout the period of growth projected for the town.

Besides the activities provided by the city, a variety of independent pursuits are possible in the magnificent natural setting of Valdez. Sightseeing opportunities abound; a drive out the Richardson Highway follows the turbulent Lowe River through lush forested hillsides to precipitous Keystone Canyon about 14 miles from downtown. Dozens of waterfalls plunge into the canyon with Horsetail and Bridal Veil falls among the most popular. A mile beyond Bridal Veil Falls, an historic marker explains that a rough handcut tunnel is the silent reminder of a railroad war shootout in 1907. About 10 miles farther is the summit of Thompson Pass, which at 2700 feet provides a breathtaking panorama of jagged peaks, tundra meadows crossed by rushing mountain streams, and alpine lakes. A few miles farther is Worthington Glacier where parking and picnic space are available, and it is possible to take a short hike to walk upon and touch the glacier.

The 30-mile drive along the Richardson is a spectacular tour, but it isn't necessary to leave the downtown area for sightseeing. At the northwest edge of town, a rough dirt road climbs Mineral Creek Canyon, passing through an area where more than 1000 mining claims were staked in the 1890s. To the east Valdez Glacier Road leads to a lake at the foot of Valdez Glacier. Across the bay is the Alyeska Marine Terminal which occupies 840 acres rising from sea level to 550 feet. This massive installation, which includes 18 storage tanks each larger than a football field, is dwarfed by the landscape. Bus tours of the facility are available or private vehicles can travel to a viewpoint near the site entrance where a statue honors the thousands of construction workers involved in the project.

There also are opportunities to observe nature more closely. Numerous small streams around the port are used for spawning by pink, chum, red and silver salmon. A special boardwalk is provided for viewing at Crooked Creek, site of the Valdez Fisheries Development Association's first fish hatchery. A second hatchery was completed at Solomon Gulch and has a total capacity of 150,000,000 eggs. The fishery has been further enhanced upon completion of the Solomon Gulch hatchery.

Valdez has many attractions for the adventuresome.

Cross-country and downhill skiing, ice-climbing, hiking, canoeing, camping, snowmachine riding, fishing and hunting opportunities are excellent. Valdez is gaining popularity as a sportfishing location. Varieties of fish taken in the area are halibut, red snapper, dolly varden and rainbow trout.

The Valdez Chamber of Commerce annually sponsors a Silver Salmon Derby from August 1 through Labor Day with grand, second and third prizes for the event as well as daily and weekly prizes. Charter boats and fishing gear are available. Other annual celebrations include Gold Rush Days during the second weekend in August, with gold rush dances, melodramas, parades, can-can girls and a beard-growing contest as part of the fun; and the Winter Carnival each March which includes sled dog races, ice sculpture contests, snowmachine races, dinner dances, poets, art shows and a Monte Carlo Night. These are among the attractions that draw thousands of tourists to Valdez each year. Many also take the opportunity to ride the private Glacier Queen luxury cruiser or the state ferry system and see Prince William Sound and the giant Columbia Glacier. In both 1980 and 1981, major motion picture productions utilized Valdez and adjacent Prince William Sound, and the area has recently been used in a national television commercial.

OTHER CONSIDERATIONS

The major considerations of siting an industrial facility in Valdez are discussed previously. In addition to the land acquisition and environmental permitting considerations, two other topics warrant mention. They are archaeological and historical features, and FAA obstruction standards.

Archaeological and Historical Features

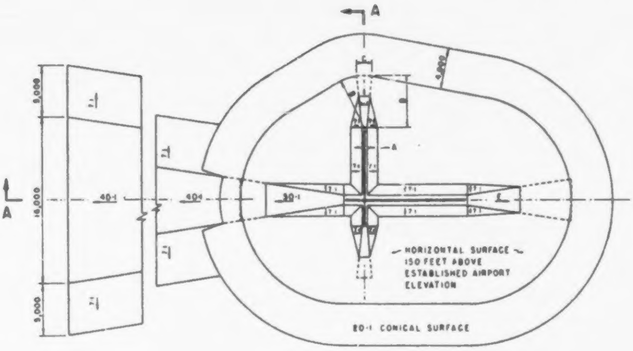
No significant archaeological or historical features are likely to be encountered in the Valdez Industrial Park area. A thorough research program was conducted for Alaska Oil Company which included consultation with the state Historic Preservation Office, literature search, helicopter reconnaissance and on-the-ground archaeological survey covering Tract B as well as access and pipeline corridors, and interviews with Valdez residents. This investigation revealed no on-site physical record of the historical events which formed Valdez and no indication of the prehistoric peoples presumed to have inhabited the region.

FAA Obstruction Standards

Federal Aviation Regulations (FAR) establish imaginary surfaces above airports which define when a structure becomes an obstruction to navigable airspace, and they create a requirement for any person proposing construction or alteration of a structure in the vicinity of an airport to notify the Federal Aviation Administration (FAA) of their plans. The FAA then evaluates the possible affects of the proposed structure on the airport operations using standards which are presented in FAR Part 77. The FAA also solicits public response before determining whether the structure is acceptable.

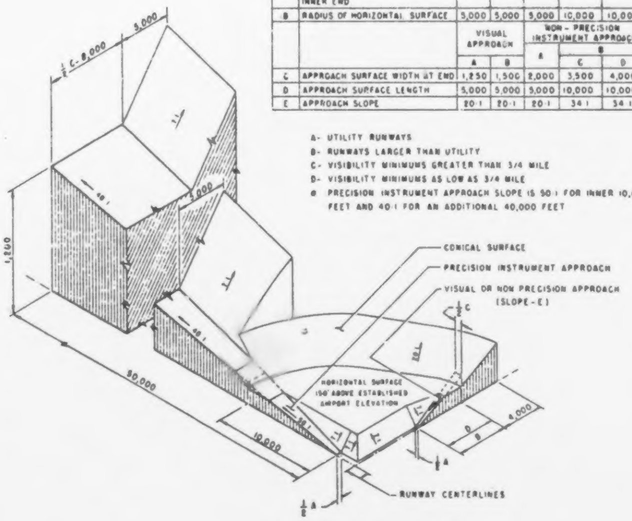
The Valdez Airport is a category B nonprecision instrument airport for purposes of applying Federal Aviation Regulations. The following diagram from FAR 77.25 shows the imaginary surfaces which apply to civil airports. The primary surface in the case of Valdez Airport is an imaginary horizontal plane 150 feet above the airport elevation which extends over the entire Industrial Park area. Any structure which would penetrate this imaginary surface requires the approval of the FAA. An FAA evaluation would consider such factors as how much the structure exceeds the obstruction standard, and where the structure is located in relation to established air traffic patterns as well as public sentiment.

The FAA obstruction standards should not impose serious constraints on the development of major industry in the Valdez Industrial Park. These standards should be considered in the planning process for development in the area, but there are portions of the Industrial Park which completely avoid current traffic patterns. An emergency flare tower approximately 300 feet high at the proposed Alaska Oil refinery on Tract B, for example, was found acceptable for construction.


A
A
C
B
5,000
5,000
16,000
5,000
40:1
40:1
7:1
50:1
20:1
— HORIZONTAL SURFACE 150 FEET ABOVE ESTABLISHED AIRPORT ELEVATION —
20:1 CONICAL SURFACE

DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON – PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
					B		
		A	B	A	C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON – PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
				A	B		
		A	B		C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET


½ C- 8,000
5,000
5,000
1,200
40:1
40:1
7:1
7:1
20:1
50:1
50,000
10,000
4,000
D
B
CONICAL SURFACE
PRECISION INSTRUMENT APPROACH
VISUAL OR NON PRECISION APPROACH (SLOPE - E)
½ C
HORIZONTAL SURFACE 150' ABOVE ESTABLISHED AIRPORT ELEVATION
½ A
½ A
RUNWAY CENTERLINES

ISOMETRIC VIEW OF SECTION A-A

§ 77.25 CIVIL AIRPORT IMAGINARY SURFACES

CAPITAL IMPROVEMENT PROJECTS

Commercial Boat Harbor

The City of Valdez plans to construct and operate a Commercial Boat Harbor primarily to serve a growing commercial fishing fleet with vessel lengths of 65 to 150 feet. The proposed site of the Commercial Boat Harbor is south of the Mineral Creek Islands east of the existing Small Boat Harbor. The site is bounded on the north by Dock Point and on the west by Kennicott Drive. The project would involve dredging of the site to a depth of minus 25 feet MLLW.

A preliminary feasibility report has been completed, and updated economic information is currently being prepared. The city is in the process of preparing a Request for Proposals to prepare a complete updated feasibility report including an environmental assessment which is necessary to obtain a Corps of Engineers permit for this work. Various alternatives are being studied to significantly reduce the total project cost.

The Valdez Fisheries Development Association, Inc. (VFDA) has established the Solomon Gulch Salmon Hatchery for the rearing of 55 million pink and 18 million chum salmon eggs in 1983. The number of pink eggs will be increased to 95 million by 1985. This work will re-establish a significant Port of Valdez salmon fisheries.

Since 1980 the number of Valdez-based fishing vessels has increased from 20 to 108. By 1985 this number is estimated to be approximately 250.

The current small boat harbor is being used to capacity. Even with the expansion of the small boat harbor now under construction, the area will be inadequate within a year to handle both commercial and private craft. The small boat harbor floats were not designed for the larger fishing vessels which are currently being berthed in the small boat harbor. Larger vessels which could base in Valdez are unable to do so because the small boat harbor is too small.

With the commercial boat harbor, plans are being made to construct a new ferry terminal adjacent to the commercial boat harbor. A new ferry terminal site has been under investigation for several years. The new terminal site in conjunction with the commercial boat harbor will meet this need.

Industrial Park Platting and Design

In 1980 the City of Valdez received from the State of Alaska patent (No. 5348) to 1657 acres in the Valdez Glacier valley. The Valdez city council in Resolution No. 8002 identified this land as the Valdez Industrial Park.

This property is adjacent to the Valdez Airport on the east and encompasses the majority of Glacier stream valley north of the Richardson Highway. The Industrial Park is divided into two large tracts by Glacier stream. The west tract is currently leased by Alpetco. The lease on this tract will expire in April of 1984.

The City of Valdez is currently pursuing economic and industrial development which will benefit Valdez and the entire State of Alaska. The Valdez Industrial Park is an important part of the city's overall economic and industrial development plan. The goals for proposed development are two-fold; first, development of an Industrial Park comprised of 10-, 20-, and 40-acre tracts for light and medium industrial activity; second, to develop a 300-acre foreign trade zone within the park. The City of Valdez is currently completing the federal application required for the foreign trade zone. The application process calls for a survey, platting and design of utilities and roadways.

To complete the Valdez Industrial Park and foreign trade zone, the following development steps must be accomplished:

1. Industrial Park Master Plan Development including
   a. planning
   b. boundary survey
   c. platting
   d. street and utility design
2. Foreign Trade Zone Master Plan Development including
   a. planning
   b. boundary survey and mapping
   c. platting
   d. street and utility design

Construction will proceed as industrial uses of the area are developed.

Small Boat Harbor Expansion

The Valdez small boat harbor is presently undergoing a 50 percent expansion in size. At the time of the original Corps of Engineers Valdez boat harbor construction, the general area to the east of the original boat harbor was left undeveloped for future harbor expansion. This area is presently being excavated to a depth of -13 MLLW which will be consistent with the bottom of the existing small boat harbor area. The excavation consists of the removal of approximately 289,000 cubic yards of soil in the harbor area.

Material removed from the harbor expansion area is being located on the Port of Valdez side of the existing spit that now separates the boat harbor from the port. This area was used as a site for disposing of the dredge material from the original boat harbor.

The widening of the spit area, on city and privately-owned property, will create a waterfront area for uses compatible with the city's Coastal Zone Management plan. These intended uses include the storage and dry docking of recreational and commercial boats, the storage of commercial fishing gear, and a parking and staging area. This site is also designated as a potential long-range planning site for expanded fin fish and shellfish processing facilities.

The expanded boat harbor area will provide additional moorage capacity for private and small commercial boats. The facility would be owned and operated by the City of Valdez.

The Valdez small boat harbor expansion project will provide development support to the commercial and recreational fishing populace.

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